- **Procedures for Asbestos Fiber Release Episodes** — If moderate to relatively large amounts of ACM are disturbed, the building owner should use these procedures to address the hazard.

A brief synopsis of worker protection and O&M work practices follows. *(Note: A more detailed, technically oriented O&M "work practices" manual specifically addressing topics such as work practices, worker protection, and specific information on how to carry out O&M plans, is being developed, with publication expected in 1991.)*

Worker Protection Programs A worker protection program includes engineering controls, personal exposure monitoring, medical surveillance, and personal protection. While engineering controls are the preferred method of worker protection, there are few engineering control options available for O&M work. This section discusses two key aspects of personal protection: use of respiratory protection and protective clothing for workers in an asbestos O&M program. According to OSHA regulations (see Chapter 6), a written respiratory protection program is necessary whenever an O&M program specifies that service workers wear respirators, or where respirators are made available to employees. OSHA regulations also require a respirator program whenever workers are exposed, or are likely to be exposed, to fiber levels above OSHA's "permissible exposure limits" such as the 8-hour time weighted average (TWA) limit or the 30-minute "excursion limit" (EL). The 8-hour TWA limit and the EL are described in more detail in Chapter 6. In addition, OSHA requires workers to wear special protective clothing under the same circumstances.

Respiratory Protection/Worker Protection Programs The selection of approved respirators, suitable for the hazards to which the worker is exposed, is only one aspect of a complete respiratory protection program. Other elements include written operating procedures for respirator use; outlining personnel responsibilities for respirator cleaning, storage, and repair; medical examination of workers for respirator use; training in proper respirator use and limitations; respirator fit testing; respirator cleaning and care; and work-site supervision. All of these are described in detail in the OSHA respirator standard, 29 CFR 1910.134. The O&M respirator program can be administered by the facility safety and health manager or the Asbestos Program Manager, if properly qualified.

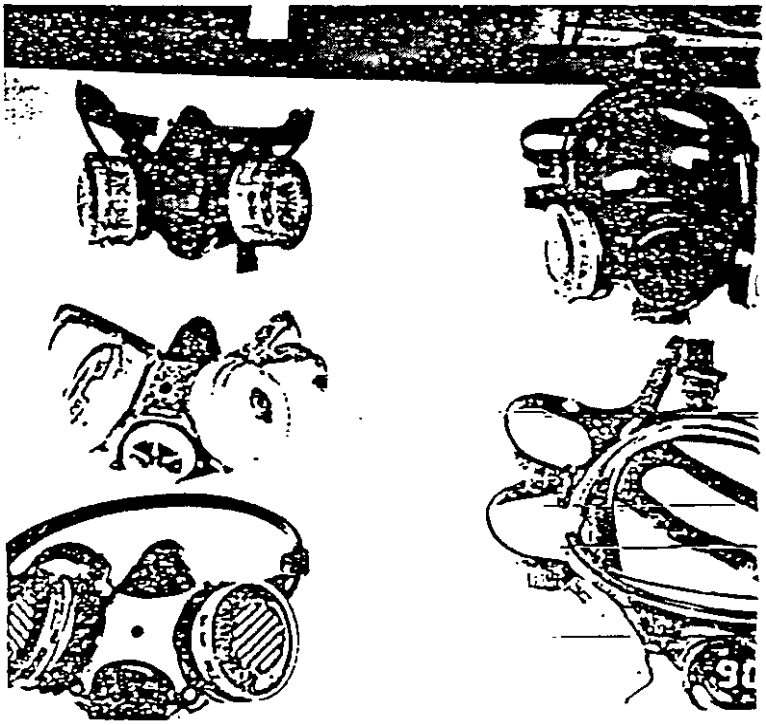
Proper respiratory protection is an integral part of all custodial and maintenance activities involving potential exposure to asbestos. When in doubt about exposure during a certain work operation, building owners should provide respiratory protection to custodial and maintenance workers. OSHA specifies general types of respirators for protection against airborne asbestos during "construction" activities, which include abatement, renovation, maintenance, repair, and remodeling.

Personal air sampling is not the same as area air monitoring. Personal air sampling (required by OSHA) is designed to measure an individual worker's exposure to fibers while the worker is conducting tasks that may disturb ACM. The sampling device is worn by the worker and positioned so that it samples air in the worker's breathing zone. In contrast, area (or ambient) air sampling is conducted to get an estimate of the numbers of airborne asbestos fibers present in a building. It is used as an assessment tool in evaluating the potential hazard posed by asbestos to all building occupants. (See the previous discussion of area air monitoring on page 14.)

When adequate care is taken to prevent or minimize and control fiber release, routine, small-scale/short-duration maintenance or custodial tasks are not likely to generate high levels of airborne asbestos compared to large asbestos removal projects; and respirators which filter breathing air may be used. OSHA, EPA, and NIOSH are on record as *not* recommending single use, disposable paper dust masks for use against asbestos; in fact, OSHA has *disallowed their use* against airborne asbestos fibers.

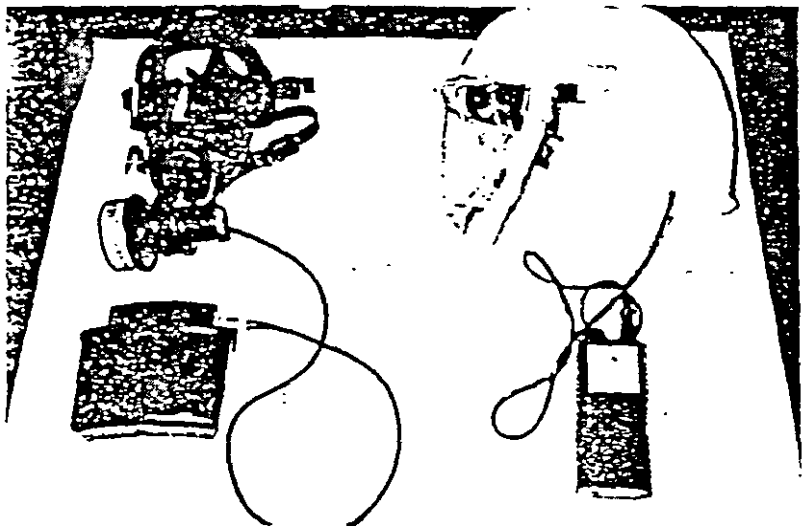
The options that may be used include:

- A half-face or full facepiece, negative pressure, air-purifying respirator with replaceable high-efficiency filters.



Pictured below are different examples of air-purifying, negative pressure respirators equipped with high-efficiency cartridges which can be used to protect workers against asbestos exposure. On the left are examples of half mask facepieces equipped with high efficiency cartridges and on the right are examples of full facepiece, high-efficiency masks.

- A half or full facepiece powered air-purifying respirator (PAPR) with replaceable high-efficiency filters. This has a battery powered pump which assists breathing and provides positive pressure in the facepiece.



Pictured above are two different types of powered air-purifying respirators (PAPR's) equipped with high-efficiency filters. On the left is an example of a tight fitting, full facepiece PAPR, and on the right is an example of a loose-fitting helmet style PAPR.

Under the OSHA standards for asbestos, any employee required to wear a negative pressure respirator can request a powered air-purifying respirator, and the employer is required to provide a fully functional and approved unit, provided it will afford the worker at least equal protection.

Currently, only respirators approved by NIOSH and the Mine Safety and Health Administration (MSHA) are permitted for use. If they are air-purifying respirators, the filtration device(s) must be rated as "high-efficiency."

Selecting the most appropriate respirator for each O&M task requires knowledge of the levels of airborne asbestos fibers and other possible air contaminants generated by the task or likely to be present where the task is performed. This knowledge is best gained through personal air monitoring conducted during worker performance of the actual task. (Obviously, the workers must have respiratory protection while this initial personal air sampling is carried out.) In fact, OSHA and EPA require air monitoring under certain circumstances (see Chapter 6). To learn more about the different types of respirators available and the degree of protection they provide, see Appendix E. Owners may also wish to contact the nearest OSHA office, a local trained and qualified industrial hygienist (preferably Certified), or an occupational health professional for more information on respirators. The expertise of these specialists should be used to ensure proper selection, fit testing, and training of workers in respirator use.

Building owners and other facility managers may not be familiar with some of the terms used in discussions of respirators, airborne fiber levels, and related topics. Appendix E contains more information on these topics, and gives the *minimum* EPA-recommended levels of respiratory protection to be provided during typical O&M tasks.

For additional information on respirator programs, respirator types, and respirator use, the building owner or Asbestos Program Manager may want to use the following references:

- "Respiratory Protection: An Employer's Manual," NIOSH, October 1978;
- "A Guide to Respiratory Protection for the Asbestos Abatement Industry," EPA/NIOSH, 1986;
- OSHA respirator standard (29 CFR 1910.134);
- OSHA asbestos regulations (29 CFR 1910.1001 and 1926.58);
- "Occupational Exposure Sampling Strategy Manual," NIOSH #77-173, January 1977.
- "Respirator Decision Logic," NIOSH, May 1987; and
- "NIOSH Guide to Industrial Respiratory Protection," September 1, 1987.

Protective Clothing/Worker Protection Programs In addition to the use of respirators, some O&M procedures may require workers to wear protective clothing. Most often, protective clothing is disposable and consists of coveralls, a head cover, and foot covers made of a synthetic fabric which does not allow asbestos fibers to pass through. This type of clothing prevents workers' regular clothing from becoming contaminated with asbestos fibers. Contaminated clothing could be taken home, creating a possible risk to the worker's family members.

OSHA and EPA regulations require workers to wear protective clothing whenever they are exposed, or likely to be exposed, to fiber levels above OSHA's permissible levels (see Chapter 6). It is important that workers be properly trained in the use, removal and disposal of protective clothing after use. All O&M activities may not require the use of protective clothing. It is important for the Asbestos Program Manager to assess this need on a case-by-case basis.

Basic O&M Procedures Basic O&M procedures to minimize and/or contain asbestos fibers may include wet methods, use of mini-enclosures, use of portable power-tools equipped with special local ventilation attachments, and avoidance of certain activities, such as sawing, sanding,

and drilling ACM. Maintenance activities can be divided into three categories with regard to their potential for disturbing ACM:

1. Those which are unlikely to involve any direct disturbance of ACM; for example, cleaning shelves or counter tops with a damp cloth.
2. Those which may cause accidental disturbance of ACM; for example, working on a fixture near a ceiling with surfacing ACM.
3. Those which involve intentional small-scale manipulation or disturbance of ACM; for example, removing a small segment of TSI ACM to repair a pipe leak.

The O&M program should include work practices for each type of ACM that is present in the building (surfacing, TSI, and miscellaneous) as well as for each type and category of maintenance activity performed (e.g., general cleaning, electrical work, plumbing).

Special work practices such as wet wiping, area isolation, and HEPA vacuuming, and the use of personal protective equipment such as respirators and protective clothing, may be needed where disturbance of ACM is likely. The need for these practices varies with the situation. For example, removing light fixtures located near surfacing ACM may disturb the material and might involve the use of special cleaning, possibly area isolation, and respiratory protection. Periodic emptying of a trash can near heavily encapsulated asbestos-containing plaster may not disturb the material at all, so no special work practices would generally be necessary. These work practices and procedures are intended to ensure that disturbance of any ACM during O&M activities should be minimized, or carried out under controlled conditions when the disturbance is required by the nature of a specific O&M task.

In addition, ACM may readily release asbestos fibers into the air when certain mechanical operations are performed directly on it. For example, fiber releases can occur when workers are drilling, cutting, sanding, breaking, or sawing vinyl asbestos floor tile.

The *action* of drilling, cutting, abrading, sanding, chipping, breaking, or sawing is the critical factor here, since it is likely to cause a release of fibers. Maintenance or repair operations involving those actions should be eliminated or carefully controlled with basic O&M procedures in order to prevent or minimize asbestos fiber release.

Certain activities that occur in the vicinity of ACM can also cause damage which may result in asbestos fiber release. For example, maintenance and custodial staff may damage ACM accidentally with broom handles, ladders, and fork lifts while performing other tasks. Activities performed in the vicinity of ACM should always be performed cautiously to prevent fiber release.

To summarize, if in doubt about the possibility of disturbing ACM during maintenance activities, adequate precautions should be taken to minimize fiber release; these will protect workers as well as the building environment. Basic O&M procedures, including use of wet methods and specially equipped tools, should be used to protect building occupants.

O&M Cleaning Practices

Special cleaning practices are appropriate for a building with exposed surfacing or thermal system insulation ACM, especially if the ACM is friable. If gradual deterioration or damage of ACM has occurred or is occurring, asbestos-containing dust or debris could be present. If the building inspection has determined that asbestos-containing dust or debris is present in some areas, then the O&M program should include special cleaning practices to collect residual asbestos dust. Routinely cleaning floors using wet methods is an example of one such practice. Custodial and maintenance workers in the course of normal work can also identify and report areas which are in need of special cleaning or repair. *Special cleaning techniques should supplement, not replace, repair or abatement actions for damaged, friable ACM.* The cleaning program should include an initial cleaning followed, as needed, by subsequent periodic or episodic cleanings.

If in doubt about the possibility of disturbing ACM during maintenance activities, adequate precautions should be taken to minimize fiber release.

Building owners and custodial and maintenance staff should ensure that special O&M cleaning is done correctly. Proper cleaning is important for two reasons:

- The use of improper techniques to clean up asbestos debris caused by previous deterioration or damage may result in widespread contamination, and potentially increase airborne asbestos fiber levels in the building.
- Improper cleaning may cause damage to the ACM, thus releasing more airborne asbestos fibers.

Proper O&M cleaning will involve the use of wet cleaning or wet-wiping practices to pick up asbestos fibers. Dry sweeping or dusting can result in asbestos fibers being re-suspended into the building's air and therefore should not be used. Once wet cloths, rags, or mops have been used to pick up asbestos fibers, they should be properly discarded as asbestos waste while still wet. They should not be allowed to dry out, since the collected fibers might be released at some later time when disturbed. The use of special vacuum cleaners, commonly referred to as HEPA vacuums, may be preferable to wet cleaning in certain situations. These vacuums are equipped with filters designed to remove very small particles or fibers — such as asbestos — by filtering those particles from the air passing through the vacuum. Since the exhaust air from an ordinary vacuum cleaner is not filtered sufficiently, it is possible for tiny asbestos fibers to pass through the filter and back into the building air.

Special procedures are generally needed to minimize the spread of fibers in the building after asbestos fiber release occurs.

It is important for O&M workers to use caution when emptying HEPA vacuums and changing the filters. Exposures could result from such activities. Workers should move the HEPA vacuum to a physically isolated area of the facility and put on proper personal protective equipment before emptying the dust and debris into properly labeled, sealed, and leak-tight containers for disposal as asbestos-containing waste. When custodial workers do not work with ACM, trained maintenance workers can be used to empty the HEPA vacuums and change their filters. Decisions regarding special cleaning practices should be based on the building inspection and ACM assessment data, including the potential for ACM disturbance. In general, the building would not need special O&M cleaning when the building contains only nonfriable (not easily crumbled) ACM; ACM which has been encapsulated, encased, or enclosed behind airtight barriers; or ACM known to be undamaged/undisturbed since the last special cleaning. Furthermore, where ACM is confined to a single room or area, special cleaning of just that area rather than other parts of the building may be sufficient.

If ACM has been released onto a carpeted area of a building, it may not always be possible to adequately clean the carpeted area. "Steam" cleaning and HEPA vacuuming methods are sometimes employed for this purpose. A preliminary study carried out by EPA in 1989 showed that hot water vacuums were more effective in carpet cleaning than HEPA vacuums, under the test conditions. Further field studies are planned to confirm these findings.

Here, a worker uses a HEPA vacuum (backpack type) to clean ACM debris from one of several carpeted areas in a room where surfacing material had fallen.

For carpets, successful cleaning will likely depend factors such as the amount of ACM released onto t carpet, how long the situation has existed, traffic ov the area, as well as the structure and composition of t carpet itself. It is prudent to evaluate individ situations on a case-by-case basis. The Asbest Program Manager should consider the need for worke engaged in cleaning asbestos fiber-contaminated c pets to wear proper respiratory protection. It may al be prudent to arrange for this type of cleaning to i done after normal working hours or when the facility less occupied. Additionally, it may be more cost effecti to properly dispose of contaminated carpets and oth fabrics as asbestos-containing waste if a permane asbestos control option is being undertaken in th building.

Where the ACM is damaged and located in an "a plenum" — where fibers can be transported by th heating, ventilation, or air conditioning (HVAC) syste throughout the building — special cleaning practice may be extended to the entire building, including th HVAC system itself.

Procedures for Asbestos Fiber Release Episodes

Special procedures ar generally needed to mir imize the spread of fiber throughout the buildin after asbestos fiber releases occur, such as the partia collapse of an ACM ceiling or wall. These procedure are needed whether the ACM disturbance is intentiona or unintentional. To provide building owners with som guidance, under EPA regulations for schools a "majo fiber release" is defined as one involving more tha three square or linear feet of ACM. The procedures t be followed will vary according to the size of the majo release episode, the amount of ACM affected, the extent of fiber release from the ACM, the relationship o the release area to the air handling systems, and whether the release site is accessible to building occupants. Depending on the severity of the episode, asbestos abatement consultants and contractors may be needed to develop a strategy for conducting the clean-up operations.

In general, for major fiber releases, the area should be isolated by closing doors and/or erecting temporary barriers to restrict airflow as well as access to the site. Signs should be posted as necessary immediately outside the fiber release site to prevent persons not involved in the cleanup operation from inadvertently entering the area. If asbestos fibers could enter the HVAC system, the system should be modified to prevent fiber entry, or should be shut down and sealed off. The final step should be to employ thorough cleanup procedures to properly control the ACM, a careful visual inspection, and final clearance air monitoring to verify satisfactory cleanup.

Similar procedures can be used for much smaller fiber release events; where the amount of ACM is on the

order of three square or linear feet or less. The HEPA vacuuming, wet wiping, and worker protection procedures outlined in this guidance document, as well as wetting ACM wastes and properly placing them in an appropriate leak-tight container (such as a properly labeled, 6-mil-thick plastic bag), are examples of some of the procedures which could be used for both major and minor fiber releases.

It is important to recognize that different levels of training are needed for workers involved with fiber release episodes. A major release will generally require "asbestos abatement worker training," rather than the degree of training considered adequate for O&M workers.

EPA suggests that building owners and Asbestos Program Managers consult with state and local regulatory officials before establishing formal training procedures for each type of situation.

The following table should be useful in determining when to apply certain O&M work practices in buildings. The table illustrates the O&M work practices that should be used by custodial and maintenance staff, depending on the likelihood of ACM disturbance.

Summary of When to Apply Key O&M Work Practices

	Likelihood of ACM Disturbance		
	Contact Unlikely	**Accidental Disturbance Possible**	**Disturbance Intended or Likely**
Management Responsibilities			
Need Pre-Work Approval from Asbestos Program Manager	Review by Program Manager	Yes	Yes
Special Scheduling or Access Control	No	Yes	Yes
Supervision Needed	No	Initial, At Least	Yes
HVAC System Modification	None	As Needed[1]	Shut Down[1]
Area Containment	None	Drop Cloths, Mini-enclosures	Yes[2]
Personal Protection			
Respiratory Protection	Available For Use	Yes	Yes
Protective Clothing	None	Review by Asbestos Program Manager	Yes
Work Practices			
Use of Wet Methods	No	As Needed	Yes
Use of HEPA Vacuum	Available For Use	Available For Use	As Needed

1) In the area where work takes place
2) Type of containment may vary. For example, small-scale, short-duration tasks may not require full containment

Recordkeeping

All the building asbestos management documents discussed in this Guide (inspection and assessment reports, O&M program plan, work practices and procedures, respirator use procedures, fiber release reports, application for maintenance work and work approval forms, evaluations of work affecting ACM, and reinspections/surveillance of ACM) should be stored in permanent files. In addition, for employees engaged in asbestos-related work, federal regulations (see Chapter 6) require that employers retain:

- personal air sampling records, for at least 30 years. Personal air samples are those collected in the worker's breathing zone during performance of work involving asbestos exposures.
- objective data used to qualify for exemptions from OSHA's initial monitoring requirements for the duration of the exemption.
- medical records for each employee subject to the medical surveillance program for the duration of their employment plus 30 years.
- all employee training records for one beyond the last date of each worker's em ment.

In addition, OSHA requires that employers provi each employee their record of exposure and me surveillance under the Records Access Standard CFR 1910.20) and the Hazard Communication Stan (29 CFR 1910.1200). See the OSHA Construction (29 CFR 1926.58) or the EPA Worker Protection (40 CFR 763 Subpart G) for more details of recordk ing requirements.

EPA recommends that building owners make avail all written elements of the O&M program to building's O&M staff as well as to tenants and ot building occupants, if applicable. Building owners also encouraged to consult with their legal cour concerning appropriate recordkeeping strategies a standard part of their O&M programs. Additiona state and local regulations may also require additio recordkeeping procedures.

EPA recommends that building owners make available all written elements of the O&M program to the building's O&M staff as well as to tenants and other building occupants.

Chapter Summary

Although the elements discussed in this chapter should appear in any O&M program, the extent to which each applies will vary depending on the building type, the type of ACM present, and the ACM's location and physical condition. To achieve its objectives an O&M program should include the following:

- A notification program to inform building occupants, workers, and tenants about the location of ACM and how to avoid disturbing ACM.
- Periodic surveillance and reinspection of ACM at regular intervals by trained workers or properly trained inspectors. Air monitoring to detect airborne asbestos fibers in the building may provide useful supplemental information when conducted along with a comprehensive visual and physical ACM inspection/ reinspection program. Air samples are most accurately analyzed using transmission electron microscopy (TEM).
- A "work control/permit" system, which some building owners have used successfully to control work that could disturb ACM. This system requires the person requesting work to submit a Job Request Form to the Asbestos Program Manager before any work is begun.
- O&M work practices to avoid or minimize fiber release during activities affecting ACM.
- Recordkeeping. OSHA and EPA have specific requirements for workers exposed to asbestos.

What O&M Training Is Necessary?

Types of Training

Training of custodial and maintenance workers is one of the keys to a successful O&M program. If building owners do not emphasize the importance of well-trained custodial and maintenance personnel, asbestos O&M tasks may not be performed properly. This could result in higher levels of asbestos fibers in the building air and an increased risk faced by both building workers and occupants.

OSHA and EPA require a worker training program for all employees exposed to fiber levels (either measured or anticipated) at or above the action level (0.1 f/cc, 8-hour *time-weighted average*—the TWA) and/or the excursion limit (1.0 f/cc, 30-minute TWA—see Chapter 6). According to the EPA regulations governing schools, all school staff custodial and maintenance workers who conduct any activities that will result in the disturbance of ACM must receive 16 hours of O&M training. Some states and municipalities may also have specific training requirements for workers who may be exposed to asbestos, or who work in a building with ACM present.

With proper training, custodial and maintenance staff can successfully deal with ACM in place, and greatly reduce the release of asbestos fibers. Training sessions should provide basic information on how to deal with all types of maintenance activities involving ACM. However, building owners should also recognize that O&M workers in the field often encounter unusual, "non-textbook" situations. As a result, training should provide key concepts of asbestos hazard control. If these concepts are clearly understood by workers and their supervisors, workers can develop techniques to address a specific problem in the field. Building owners who need to provide O&M training to their custodial and maintenance staff should contact an EPA environmental assistance center (see Appendix D) or equally qualified training organization for more information.

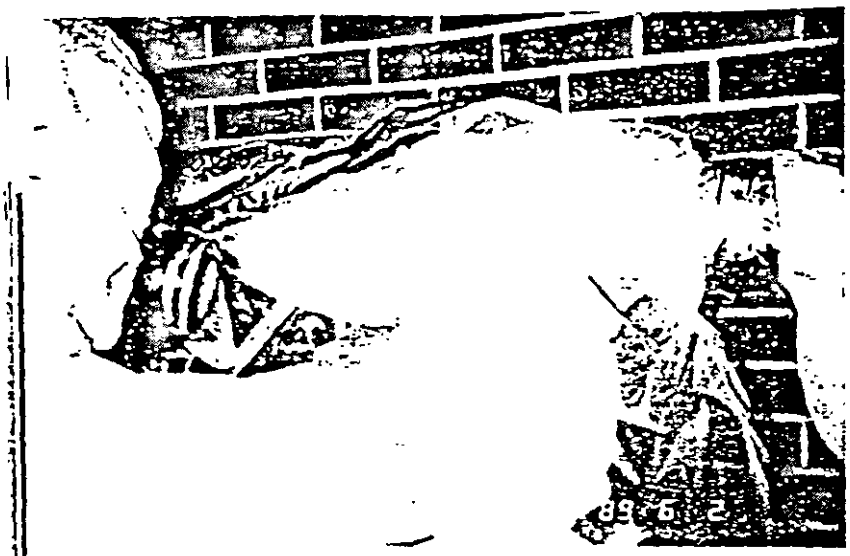
At least three levels of maintenance worker training can be identified:

LEVEL 1: AWARENESS TRAINING. For custodians involved in cleaning and simple maintenance tasks where ACM may be accidentally disturbed.

For example, fixing a light fixture in a ceiling covered with surfacing ACM. Such training may range from two to eight hours, and may include such topics as:

- Background information on asbestos.
- Health effects of asbestos.
- Worker protection programs.
- Locations of ACM in the building.
- Recognition of ACM damage and deterioration.
- The O&M program for that building.
- Proper response to fiber release episodes.

Training of custodial and maintenance workers is one of the keys to a successful O&M program.

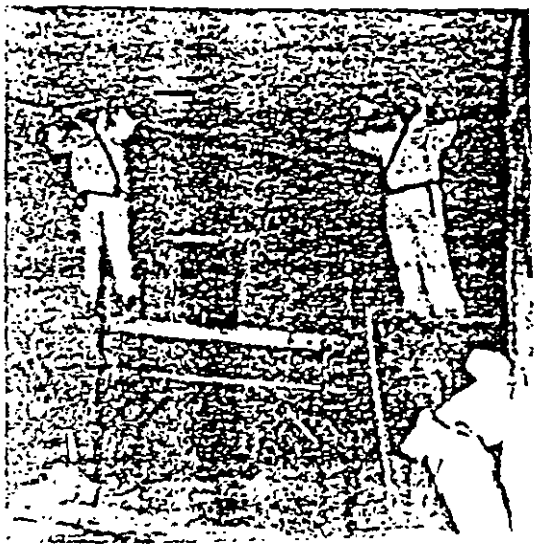


A properly protected and trained worker conducts a glovebag removal job on a section of thermal system insulation. Under a proper operations and maintenance program, any worker involved in such activities would have Level 1 and 2 training.

LEVEL 2: SPECIAL O&M TRAINING. For maintenance workers involved in general maintenance and asbestos material repair tasks.

For example, a repair or removal of a small section of damaged TSI, or the installation of electrical conduit in an air plenum containing ACM or ACM debris. Such training generally involves at least 16 hours. This level of training usually involves more detailed discussions of the topics included in Level 1 training as well as:

- Federal, state, and local asbestos regulations.
- Proper asbestos-related work practices.
- Descriptions of the proper methods of handling ACM, including waste handling and disposal.
- Respirator use, care, and fit-testing.
- Protective clothing donning, use, and handling.
- Hands-on exercises for techniques such as glovebag work and HEPA vacuum use and maintenance.
- Appropriate and proper worker decontamination procedures.



This is an example of a large-scale asbestos removal project (note missing scaffold safety rails). Such projects are well beyond the scope of an O&M program. The EPA NESHAP regulations require that asbestos materials be removed from buildings prior to demolition or renovation when the asbestos will be disturbed.

LEVEL 3: ABATEMENT WORKER TRAINI
For workers who may conduct asbes abatement.

For example, conducting a removal job, constructing enclosure, or encapsulating a surface containing AC This work involves direct, intentional contact w ACM. The recognized "abatement worker" train courses approved by EPA or states, under the E AHERA model accreditation plan for schools, wh involve 24 to 32 hours of training, would fulfill this le of training.

If this level of training is provided to in-house staff may save time and money in the long run to use the individuals to perform such activities. This level training is much more involved than Levels 1 and although it should include some of the same elemer (e.g., health effects of asbestos). It will typically inclu a variety of specialized topics, such as:

- Pre-asbestos abatement work activities.
- Work area preparation.
- Establishing decontamination units.
- Personal protection, including respirator sele tion, use, fit-testing, and protective clothin
- Worker decontamination procedures.
- Safety considerations in the abatement wor area.
- A series of practical hands-on exercises.
- Proper handling and disposal of ACM waste

The Asbestos Program Manager should consider con ducting the training program for Levels 1 and 2 if he o she has sufficient specific asbestos knowledge an training. If the Asbestos Program Manager does no conduct the training, the building owner should hire a outside consultant or send workers to an appropriat O&M training course. A trained (preferably Certified) industrial hygienist or equally qualified safety and healt professional should conduct the training on respirator use and fit-testing. A health professional should conduct the training on health effects.

OSHA or EPA Regional Offices, as well as state and local agencies and professional associations, may be able to suggest courses or direct you to listings of training providers for each of the three levels. Appendix D provides the addresses and/or phone numbers for OSHA, EPA, and EPA-sponsored training providers.

Where custodial and maintenance services are performed by a service company under contract, or where some installation or repairs are performed by employees of trade or craft contractors and subcontractors, those workers may need to have training at level 1, 2, or 3 as appropriate for their work. The Asbestos Program Manager or building owner should verify that these employees receive appropriate training before they begin any work.

In summary, good training is crucial to the success of an O&M program. Strong support for O&M training by the building owner should convince custodial and maintenance workers that following the appropriate work procedures is critical to protecting their own health as well as the health of other building occupants.

Chapter Summary

Properly trained custodial and maintenance workers are critical to a successful O&M program. The following items are highlighted training requirements:

- OSHA and EPA require worker training program for all employees exposed to fiber levels at or above the action level (0.1 f/cc, 8-hr. TWA) and/or the excursion limit (1.0 f/cc, 30-minute TWA — see Chapter 6).
- Some states and municipalities may have specific worker training requirements.
- At least three levels of maintenance worker training can be identified:

  Level 1 Awareness training for workers involved in activities where ACM may be accidentally disturbed. May range from 2-8 hours.

  Level 2 Special O&M training for maintenance workers involved in general maintenance and incidental ACM repair tasks. At least 16 hours.

  Level 3 Abatement worker training for workers who may conduct asbestos abatement. This work involves direct, intentional contact with ACM. "Abatement worker" training courses that involve 24 to 32 hours of training fulfill this level of training.

Strong support by the building owner can convince workers that following appropriate procedures is critical to protecting their own health as well as the health of other building occupants.

What Regulations Affect Asbestos Management Programs in Buildings, Especially O&M Programs?

Federal, State, and Local Regulations Affecting O&M Programs

Building owners are governed by a variety of federal, state, and local regulations which influence the way they must deal with ACM in their facilities. Some of these regulations, particularly at the state and local level, may change frequently. Building owners should contact their state and local government agencies, in addition to organizations such as the National Conference of State Legislatures (NCSL), the National Institute of Building Sciences (NIBS), or EPA environmental assistance centers, for updated information on these requirements. (Appendix D lists phone numbers for these organizations.)

Building owners are governed by a variety of federal, state, and local regulations which influence the way they must deal with ACM in their facilities.

OSHA Regulations and the U.S. EPA Worker Protection Rule

There are several important Occupational Safety and Health Administration (OSHA) and EPA regulations that are designed to protect workers. They are summarized here, as guidance. OSHA has specific requirements concerning worker protection and procedures used to control ACM. These include the OSHA construction industry standard for asbestos (29 CFR 1926.58), which applies to O&M work, and the general industry asbestos standard (29 CFR 1910.1001). State-delegated OSHA plans, as well as local jurisdictions, may impose additional requirements.

For most operations and maintenance activities in building areas where only non-friable ACM is present or where friable ACM is in good condition, applicable OSHA permissible exposure limits are not likely to be exceeded. However, it is possible that some O&M activities will disturb ACM to such an extent that the OSHA limits are exceeded, unless good work practices are followed.

The OSHA standards generally cover private sector workers, and public sector employees in states which have an OSHA state plan. Public sector employees, such as city or county government employees, or certain school employees, who are not already subject to a state OSHA plan are covered by the EPA "Worker Protection Rule" (Federal Register: February 25, 1987; 40 CFR 763 Subpart G, Asbestos Abatement Projects; Worker Protection, Final Rule). *Note: As this document goes to press, OSHA is considering a substantial number of changes to its regulations.*

The OSHA standards and the EPA Worker Protection Rule require employers to address a number of items which are triggered by exposure of employees to asbestos fibers. Exposure is discussed in terms of fibers per cubic centimeter (cc) of air. A cc is a volume approximately equivalent to that of a sugar cube.

Two main provisions of the regulations fall into the general category of "Permissible Exposure Limits (PELs)" to airborne asbestos fibers. They are:

1. **8-Hour Time-weighted average limit (TWA)**—0.2 fiber per cubic centimeter (f/cc) of air based on an 8-hour time-weighted average (TWA) sampling period. This is the maximum level of airborne asbestos, on average, that any employee may be exposed to over an 8-hour period (normal work shift).
2. **Excursion limit (EL)**—1.0 f/cc as averaged over a sampling period of 30 minutes.

These levels trigger mandatory requirements, which include the use of respirators and protective clothing, the establishment of "regulated areas," the posting of danger signs as well as the use of engineering controls and specific work practices.

OSHA regulations also establish an *"Action Level"*: 0.1 f/cc for an 8-hour TWA. Employee training is required once the action level of 0.1 f/cc and/or the "Excursion Limit" is reached. This training must include topics specified by the OSHA rules. If an employee is exposed at or above the action level for a period of 30 days or more in a calendar year, medical surveillance is required according to the OSHA construction industry asbestos standard.

OSHA also requires medical examinations under its "General Industry Standard" for any employee exposed to fiber levels in the air at or above the OSHA "action level" (0.1 f/cc) and/or the "excursion limit" (1.0 f/cc). In both cases—the action level and excursion limit—the OSHA medical examination requirement applies if the exposure occurs for at least one day per year.

The OSHA "Construction Industry Standard" (29 CFR 1926.58) for asbestos, is generally applicable for the workers who carry out the kinds of work discussed in this O&M guidance document. The OSHA construction industry asbestos standard applies to demolition and asbestos removal or encapsulation projects, as well as to repair, maintenance, alteration, or renovation if ACM is involved. ACM spills or emergency clean-up actions are also covered by this regulation.

According to those regulations, participation in a medical surveillance program is required for any employee who is required to wear a negative pressure, air-purifying respirator. Preplacement, annual, and termination physical exams are also required for these employees. However, a termination exam is only necessary under the construction industry standard (which applies to custodial and maintenance employees) if a physician recommends it. While not mandatory, EPA and NIOSH recommend physical examinations, including cardiac and pulmonary tests, *for any employee* required to wear a respirator by the building owner. These tests determine whether workers will be unduly stressed or uncomfortable when using a respirator.

Additional requirements of the OSHA asbestos standards, such as the use of air filtration systems and hygiene facilities, involve procedures which are most applicable to large-scale asbestos abatement projects. However, these rules also include a number of recommendations for procedures which might be appropriate for a variety of O&M programs for buildings.

Small-scale, Short-duration Projects

"Appendix G" which is specified as a non-mandatory section to the OSHA regulation 29 CFR 1926.58, may become mandatory under certain circumstances where "small-scale, short-duration" asbestos projects are conducted. These projects are not precisely defined in terms of either size or duration, although their nature and scope are illustrated by examples presented in the text of the regulation. Properly trained maintenance workers may conduct these projects. Examples may include removing small sections of pipe insulation or covering for pipe repair, replacing valves, installing electrical conduits, or patching or removing small sections of drywall. OSHA issued a clarification of the definition of a "small-scale, short-duration" (SS/SD) project in a September 1987 asbestos directive. The directive focuses on intent, stating that in SS/SD projects, the removal of ACM is not the primary goal of the job. If the purpose of a small-scale, short-duration project is maintenance, repair, or renovation of the equipment or surface behind the ACM—not abatement of ACM—then the appendix provisions may apply. If the intent of the work is abatement of the ACM, then the full-scale abatement control requirements apply.

In any event, this appendix section of the OSHA construction standard outlines requirements for the use of certain engineering and work practice controls such as glovebags, mini-enclosures, and special vacuuming techniques. Similar information on these procedures may be found in the EPA's AHERA regulations for schools. (See final AHERA rule, Appendix B, for SS/SD projects.)

U.S. EPA National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 CFR 61 Subpart M)

EPA's rules concerning the application, removal, and disposal of ACM, as well as manufacturing, spraying and fabricating of ACM, were issued under the asbestos NESHAP. The asbestos NESHAP regulation governs asbestos demolition and renovation projects in all facilities. The NESHAP rule usually requires owners or operators to have all friable ACM removed before a building is demolished, and may require its removal *before* a renovation. For renovation projects where friable ACM will be disturbed, the NESHAP rule may require appropriate work practices or procedures for the control of emissions. It is prudent to note that any ACM which may become friable poses a potential hazard that should be addressed. The building owner should consider that in many instances, the removal of friable ACM prior to demolition could be less expensive than removals while the building is still occupied and being used. *Some revisions to the current NESHAP rule are anticipated by the end of 1990.*

In general, applicable OSHA permissible exposure limits are not likely to be exceeded for most O&M activities in building areas where only non-friable ACM is present or where friable ACM is in good condition.

Notification

EPA or the state (if the state has been delegated authority under NESHAP) must be notified before a building is demolished or renovated. The following information is required on the NESHAP notice:

1. Name and address of the building owner or manager;
2. Description and location of the building;
3. Estimate of the approximate amount of friable ACM present in the facility;
4. Scheduled starting and completion dates of ACM removal;
5. Nature of planned demolition or renovation and method(s) to be used;
6. Procedures to be used to comply with the requirements of the regulation; and
7. Name, address, and location of the disposal site where the friable asbestos waste material will be deposited.

Depending on project size, EPA or the state must be notified before a building is demolished or renovated.

The notification requirements do not apply if a building owner plans renovation projects which will disturb less than the NESHAP limits of 160 square feet of friable ACM on facility components or 260 linear feet of friable ACM on pipes (quantities involved over a one-year period). For renovation operations in which the amount of ACM equals or exceeds the NESHAP limits, notification is required as soon as possible.

Emissions Control and Waste Disposal

The NESHAP asbestos rule prohibits visible emissions to the outside air by requiring emission control procedures and appropriate work practices during collection, packaging, transportation or disposal of friable ACM waste. All ACM must be kept wet until sealed in a leak-tight container that includes the appropriate label. The following table provides a simplified reference for building owners regarding the key existing NESHAP requirements.

Resource Conservation and Recovery Act Regulations (RCRA); and Comprehensive Environmental Response, Compensation, and Liability Act Regulations (CERCLA, or "Superfund")

Under expanded authority of RCRA, a few states have classified asbestos-containing waste as a hazardous waste, and require stringent handling, manifesting, and disposal procedures. In those cases, the state hazardous waste agency should be contacted before disposing of asbestos for approved disposal methods and recordkeeping requirements, and for a list of approved disposal sites.

Friable asbestos is also included as a hazardous substance under EPA's CERCLA regulations. The owner or manager of a facility (e.g., building, installation, vessel, landfill) may have some reporting requirements. Check with your EPA Regional Office for further information (See Appendix D for telephone numbers.)

The Asbestos Hazard Emergency Response Act Regulations (AHERA)

In October 1987 EPA issued final regulations to carry out the Asbestos Hazard Emergency Response Act of 1986 (AHERA). The AHERA regulatory requirements deal *only with public and private elementary and secondary school buildings.* The regulations require schools to conduct inspections, develop comprehensive asbestos management plans, and select asbestos response actions to deal with asbestos hazards. The AHERA rules *do not* require schools to remove ACM.

A key element of the AHERA regulations requires schools to develop an O&M program if friable ACM is present. The AHERA O&M requirements also cover non-friable ACM which is about to become friable. For example, drilling through an ACM wall will likely result in friable ACM. Under the AHERA O&M provisions, schools must carry out specific O&M procedures which provide for the clean-up of any ACM releases and help ensure the general safety of school maintenance and custodial workers, as well as all other school building occupants. The AHERA regulation's O&M requirements mandate that schools employ specific work practices including wet wiping, HEPA vacuuming, proper waste disposal procedures, and specific training for custodial and maintenance employees who work in buildings with ACM.

U.S. EPA Asbestos Ban and Phaseout Rule

Bans on some uses and applications of asbestos under the Clean Air Act were briefly described in Chapter 1. In July 1989, under the Toxic Substances Control Act (TSCA), EPA promulgated an Asbestos Ban and Phaseout Rule. The complete rule was published in the *Federal Register* on July 12, 1989.

Beginning in 1990 and taking effect in three stages, the rule prohibits the importation, manufacture, and processing of 94 percent of all remaining asbestos products in the United States over a period of seven years.

Existing NESHAP Requirements Summary*

	Demolition		Renovation	
AMOUNT* (in 1 yr.)	≥260 ln.ft. or ≥ 160 sq. ft.	<260 ln.ft. or <160 sq.ft.	≥260 ln ft. or ≥ 160 sq. ft	<260 ln. ft. <160 sq. ft.
NOTIFICATION	YES	YES	YES	NOT REQUIRED
HOW FAR IN ADVANCE*	10 DAYS	20 DAYS	AS SOON AS POSSIBLE	NOT REQUIRED
EMISSION CONTROLS (Work Practices)	YES	NOT REQUIRED	YES	NOT REQUIRED
DISPOSAL STANDARD	YES	NOT REQUIRED	YES	NOT REQUIRED

*May be changed on promulgation of Revised NESHAP Rule in 1990

Chapter Summary

A variety of federal, state, and local regulations govern the way building owners must deal with ACM in their facilities. State and local regulations may be more stringent than federal standards and often change rapidly. Building owners should periodically check with the appropriate Federal, State, and local authorities to determine whether any new asbestos regulations have been developed or whether current regulations have been amended. Specific federal regulations that may affect asbestos-related tasks and/or workers are highlighted here:

- ○ OSHA Construction Industry Standard for Asbestos (29 CFR 1926.58).
- ○ OSHA General Industry Standard for Asbestos (29 CFR 1910.1001).
- ○ OSHA Respiratory Protection Standard (29 CFR 1910.134).
- ○ EPA Worker Protection Rule (40 CFR 763 Subpart G).
- ○ EPA National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 CFR 61 Subpart M).
- ○ EPA Asbestos Hazard Emergency Response Act (AHERA) Regulations (40 CFR 763 Subpart E).
- ○ EPA Asbestos Ban and Phaseout Rule (40 CFR 763 Subpart I).

Appendix A.

Glossary of Terms

ACM	Asbestos-Containing Material. Any material containing more than one percent asbe
Asbestos Program Manager	A building owner or designated representative who supervises all aspects of the fac asbestos management and control program.
Air Plenum	Any space used to convey air in a building or structure. The space above a suspended ce is often used as an air plenum.
Asbestos Abatement	Procedures to control fiber release from asbestos-containing materials in a building o remove it entirely. These may involve removal, encapsulation, repair, enclos encasement, and operations and maintenance programs.
Delamination	Separation of one layer from another.
EPA	U.S. Environmental Protection Agency
Friable Asbestos	Any materials that contain greater than one percent asbestos, and which can be crumbl pulverized, or reduced to powder by hand pressure. This may also include previously n friable material which becomes broken or damaged by mechanical force.
Glovebag	A polyethylene or polyvinyl chloride bag-like enclosure affixed around an asbest containing source (most often, TSI) so that the material may be removed while minimizi release of airborne fibers to the surrounding atmosphere.
HEPA Filter	High-Efficiency Particulate Air Filter. Such filters are rated to trap at least 99.97% of particles 0.3 microns in diameter or larger.
Industrial Hygienist	A professional qualified by education, training, and experience to anticipate, recoghiz evaluate and develop controls for occupational health hazards.
Medical Surveillance	A periodic comprehensive review of a worker's health status. The required elements of a acceptable medical surveillance program are listed in the Occupational Safety and Healt Administration standards for asbestos.
Miscellaneous ACM	Interior asbestos-containing building material on structural components, structur members or fixtures, such as floor and ceiling tiles; does not include surfacing material c thermal system insulation.
NESHAP	National Emission Standard for Hazardous Air Pollutants—EPA Rules under the Clean Ai Act.
NIOSH	The National Institute for Occupational Safety and Health, which was established by th Occupational Safety and Health Act of 1970. Primary functions of NIOSH are to conduc research, issue technical information, and test and certify respirators.
Personal Air Samples	An air sample taken with a sampling pump directly attached to the worker with th collecting filter and cassette placed in the worker's breathing zone. These samples ar required by the OSHA asbestos stand. ds and the EPA Worker Protection Rule.
Prevalent Level Samples	Air samples taken under normal conditions (also known as ambient background samples)
Surfacing ACM	Asbestos-containing material that is sprayed-on, troweled-on or otherwise applied to surfaces, such as acoustical plaster on ceilings and fireproofing materials on structura members, or other materials on surfaces for acoustical, fireproofing, or other purposes
TSI	Thermal system insulation — asbestos-containing material applied to pipes, fittings boilers, breeching, tanks, ducts or other interior structural components to prevent heat loss or gain or water condensation.
TWA	Time-weighted Average. In air sampling, this refers to the average air concentration of contaminants during a particular sampling period.

Appendix B.

Sample Recordkeeping Forms

Form 1. A sample form for recording information during ACM reassessment.

Reinspection of Asbestos-Containing Materials

Location of asbestos-containing material (address, building, room, or general description):

_____

_____

_____

_____

Type of asbestos-containing material(s):
1. Sprayed- or troweled-on ceilings or walls
2. Sprayed- or troweled-on structural members
3. Insulation on pipes, tanks, or boiler
4. Other (describe):

_____

_____

Abatement Status:

1. The material has been encapsulated _____, enclosed _____, neither _____, removed _____.

Assessment:

1. Evidence of physical damage: _____

_____

2. Evidence of water damage: _____

_____

3. Evidence of delamination or other damage: _____

_____

4. Degree of accessibility of the material: _____

_____

5. Degree of activity near the material: _____

_____

6. Location in an air plenum, air shaft, or airstream: _____

_____

7. Other observations (including the condition of the encapsulant or enclosure, if any): _____

_____

*Recommended Action: _____

_____

Signed: _____ Date: _____
(evaluator)

Form 2. ... sample application form for maintenance work approval.

Job Request Form for Maintenance Work

Name:_____ Date:_____

Telephone No._____ Job Request No. _____

Requested starting date:_____ Anticipated finish date:_____

Address, building, and room number(s) (or description of area) where work is to be performed:

_____

_____

_____

_____

Description of work:

_____

_____

_____

_____

_____

Description of any asbestos-containing material that might be affected, if known (include location and type):

_____

_____

_____

_____

_____

Name and telephone number of requestor:

_____

Name and telephone number of supervisor:

_____

Submit this application to:

_____

(The Asbestos Program Manager)

NOTE: An application must be submitted for all maintenance work whether or not asbestos-containing material might be affected. An authorization must then be received before any work can proceed.

_____ Granted (Job Request No._____)
_____ With conditions*
_____ Denied

*Conditions: _____

_____

Form 3. A sample maintenance work authorization form.

Maintenance Work Authorization Form

No._____

AUTHORIZATION

Authorization is given to proceed with the following maintenance work:

_____

_____

_____

_____

_____

_____

_____

_____

PRESENCE OF ASBESTOS-CONTAINING MATERIALS

____ Asbestos-containing materials are not present in the vicinity of the maintenance work.

____ ACM is present, but its disturbance is not anticipated; however, if conditions change, the Asbestos Program Manager will re-evaluate the work request prior to proceeding.

____ ACM is present, and may be disturbed.

Work Practices if Asbestos-Containing Materials Are Present

The following work practices shall be employed to avoid or minimize disturbing asbestos:*

_____

_____

_____

_____

_____

Personal Protection if Asbestos-Containing Materials Are Present**

The following equipment/clothes shall be used/worn during the work to protect workers:

_____

_____

_____

_____

(manuals on personal protection can be referenced)

Special Practices and/or Equipment Required:

_____

_____

Signed: _____ Date: _____

(Asbestos Program Manager)

Form – sample work evaluation form

Evaluation of Work Affecting Asbestos-Containing Materials

This evaluation covers the following maintenance work:

Location of workd (address, building, room number(s), or general description):

_____

_____

_____

_____

Date(s) of work: _____

Description of work: _____

Work approval form number: _____

Evaluation of work practices employed to minimize disturbance of asbestos:

_____

_____

_____

_____

_____

Evaluation of work practices employed to contain released fibers and to clean up the work area:

_____

_____

_____

_____

_____

Evaluation of equipment and procedures used to protect workers:

_____

_____

_____

_____

_____

Personal air monitoring results: (in-house worker or contract?)

Worker name _____ Results: _____

Worker name _____ Results: _____

Handling or storage of ACM waste: _____

Signed: _____ Date: _____
(Asbestos Program Manager)

Appendix C.

Illustrative Organization Charts

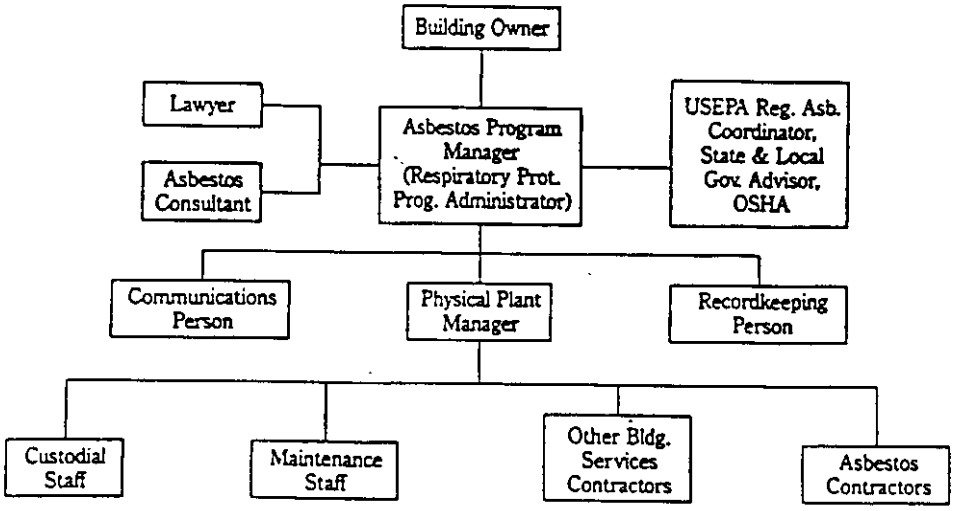


Figure 1. A *sample* organization for a building owner with a large in-house management staff. Shaded boxes indicate outside assistance.

Owners and Managers Who Employ an Extensive In-house Management Staff

IN-HOUSE STAFF (FIGURE 1)

Asbestos Program Manager: Has authority and overall responsibility for the asbestos control program. May develop the O&M program. Coordinates all activities. May also administer the respiratory protection program.

Physical Plant Manager: (may also be the Asbestos Program Manager) Participates in establishing work practices for cleaning and maintenance activities, and in training custodial and maintenance staff to use them. Assists in implementing the O&M program and in conducting periodic reinspections of the ACM. Ensures that outside contractors follow O&M procedures.

Communications Person: (Public Affairs Officer, Nurse, Physician, Industrial Hygienist) Assists in preparation and distribution of information about ACM in the building. Person should be a good speaker and communicator.

Recordkeeping Person: (Executive Assistant, Secretary) Responsible for maintaining records.

OUTSIDE ASSISTANCE

EPA Regional Asbestos Coordinator, NESHAP Coordinator and State/Local Government Advisors: Provide general guidance and answer specific questions.

OSHA Regional Office: May be helpful in answering questions about existing regulations, and providing guidance for worker protection.

Asbestos Consultant(s)*: (Industrial Hygienists, Health Professionals, Architects, Engineers, and others) May assist in various aspects of the asbestos O&M program, including its development and implementation. May also conduct material inspections and provide work practice recommendations.

Lawyer: Provides advice on legal requirements (such as laws and statutes) and liability aspects of the program.

Asbestos Contractor*: May provide services for ACM abatement and for building decontamination following a fiber release episode.

*It is important for owners and Asbestos Program Manager's to consider potential "conflict of interest" issues pertaining to those persons or firms used to sample, inspect, assess, analyze, recommend response actions, design response actions, and conduct asbestos response actions.

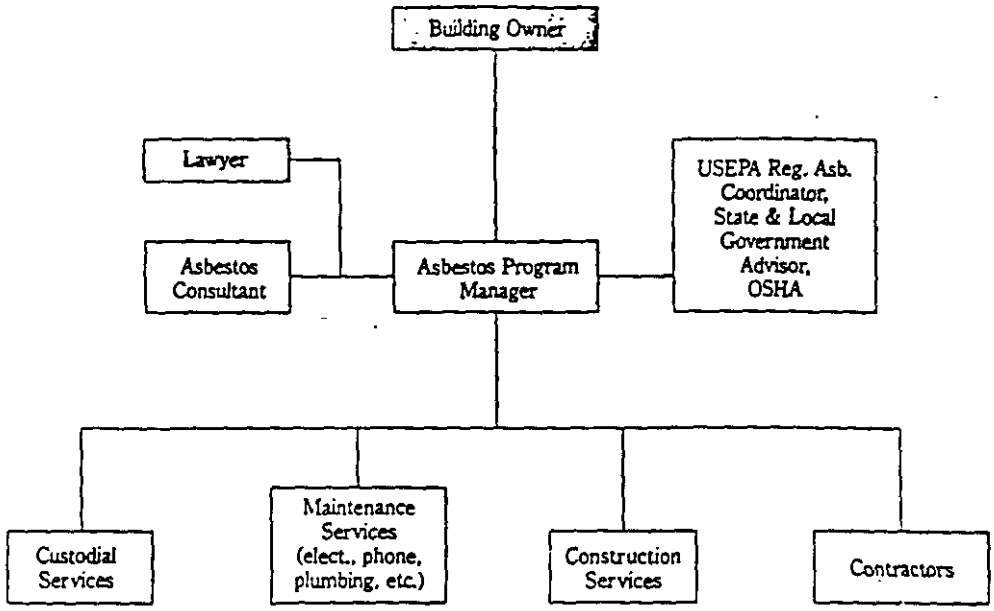


Figure 2. A *sample* organization for owners of buildings where services are provided by contract. Shaded boxes indicate outside assistance.

Owners and Managers Who Contract For Services

IN-HOUSE STAFF (FIGURE 2)

Asbestos Program Manager: Has overall responsibility for the asbestos control program. May develop and implement the O&M program. Establishes training and experience requirements for contractor's workers. Supervises and enforces work practices with assistance of work crew supervisors. Conducts periodic reinspections and responsible for recordkeeping. This person should be properly trained in O&M program development and implementation (see Chapter 5).

OUTSIDE ASSISTANCE

EPA Regional Asbestos Coordinator and State/Local Government Advisors: Provide general guidance and answer specific questions.

OSHA Regional Office: May be helpful in answering questions about existing regulations and providing guidance for worker protection.

Asbestos Consultant(s)*: (Industrial Hygienists, Health Professionals, Architects, Engineers, and others) May assist Asbestos Program Manager in various aspects of the asbestos O&M program, including development and implementation. May also conduct the inspection and provide work practices recommendations.

Lawyer: Provides advice on legal requirements (laws and statutes) and liability aspects of the program.

Asbestos Contractor*: May provide services for ACM abatement and building decontamination following a fiber release episode.

*It is important for owners and Asbestos Program Manager's to consider potential "conflict of interest" issues pertaining to those persons or firms used to sample, inspect, assess, analyze, recommend response actions, design response actions, and conduct asbestos response actions.

APPENDIX D.

Additional Assistance and Training

EPA REGIONAL CONTACTS

Additional assistance can be obtained from your U.S. EPA Regional Asbestos Coordinators, NESHAP Regional Coordinators, and OSHA Regional Offices. Their telephone numbers are listed below:

EPA Region I: (CT,ME,MA,NH,RI,VT)
Asbestos Coordinator (617) 565-3835
NESHAP Coordinator (617) 565-3265

EPA Region II: (NJ,NY,PR,VI)
Asbestos Coordinator (201) 321-6671
NESHAP Coordinator (212) 264-6770

EPA Region III: (DE,DC,MD,PA,VA,WV)
Asbestos Coordinator (215) 597-3160
NESHAP Coordinator (215) 597-6550

EPA Region IV: (AL,FL,GA,KY,MS,NC,SC,TN)
Asbestos Coordinator (404) 347-5014
NESHAP Coordinator (404) 347-2904

EPA Region V: (IL,IN,MI,MN,OH,WI)
Asbestos Coordinator (312) 886-6003
NESHAP Coordinator (312) 353-2088

EPA Region VI: (AR,LA,NM,OK,TX)
Asbestos Coordinator (214) 655-7244
NESHAP Coordinator (214) 655-7229

EPA Region VII: (IA,KS,MO,NE)
Asbestos Coordinator (913) 551-7020
NESHAP Coordinator (913) 551-7020

EPA Region VIII: (CO,MT,ND,SD,UT,WY)
Asbestos Coordinator (303) 293-1442
NESHAP Coordinator (303) 294-7685

EPA Region IX: (AZ,CA,HI,NV,AS,GU)
Asbestos Coordinator (415) 556-5406
NESHAP Coordinator (415) 556-5526

EPA Region X: (AK,ID,OR,WA)
Asbestos Coordinator (206) 442-4762
NESHAP Coordinator (206) 442-1757

OSHA REGIONAL OFFICES

Region I — Boston, MA: (617) 223-6710
Region II — New York, NY: (212) 944-3432
Region III — Philadelphia, PA: (215) 596-1201
Region IV — Atlanta, GA: (404) 347-3573
Region V — Chicago, IL: (312) 353-2220
Region VI — Dallas, TX: (214) 767 4731
Region VII — Kansas City, MO: (816) 374-5861
Region VIII — Denver, CO: (303) 844-3061
Region IX — San Francisco, CA: (415) 995-5672
Region X — Seattle, WA: (206) 442-5930

Toxic Substances Control Act (TSCA) Assistance Hotline

Copies of the EPA Guidance Documents, Technical Bulletins, and other publications cited here can be obtained by calling the TSCA Assistance Hotline, in Washington, D.C., at: (202) 554-1404.

Approved Training Centers

Certain training centers and satellite centers were initially funded by EPA to develop asbestos training courses. They, and other training providers approved by EPA or states, offer courses for professionals such as asbestos inspectors and management planners involved with ACM detection and control, for asbestos abatement project designers, project supervisors and abatement workers, and others. In general, qualified professionals trained as inspectors and asbestos management planners would be good choices to design an O&M plan. Original training centers are located at the following sites:

Georgia Institute of Technology
GTRI/EDL/ESTD
29 O'Keefe Building
Atlanta, GA 30332
(404) 894-3806

University of Kansas
Asbestos Training Center
6600 College Blvd. Suite 315
Overland Park, KS 66211
(913) 491-0181

Pacific Asbestos
Information Center
University CA/Extension
2223 Fulton St.
Berkeley, CA 94720
(415) 643-7143

Tufts University
Curtis Hall
Asbestos Information Center
474 Boston Avenue
Medford, MA 02155
(617) 381-3531

University of Illinois at Chicago
Midwest Asbestos Information Center
Box 6998
Chicago, IL 60680
(312) 996-6904

Additional training providers are listed in the *Federal Register* on a regular basis. Call (202) 554-1404 for information. In addition, information on how to receive a copy of an O&M Course produced by an EPA contractor may be obtained at the same number.

OTHER ORGANIZATIONS

National Conference of State Legislatures (NCSL)
Denver, CO — (303) 623-7800
National Institute of Building Sciences (NIBS),
Washington, D.C. — (202) 289-7800
American Board of Industrial Hygiene (ABIH),
Lansing, MI — (517) 321-2638
National Institute for Standards and Technology (NIST),
Gaithersburg, MD — (contact for lab accreditation) —
(301) 975-4016

APPENDIX E:

Respiratory Protection Recommendations

EPA recommends that the following guidelines be followed for respiratory protection during various custodial and maintenance tasks. These guidelines are issued to cover tasks that do not always create routine fiber levels high enough to trigger OSHA respiratory protection requirements. Therefore, building owners should note they go *beyond* OSHA requirements.

- **Routine maintenance where contact with ACM is unlikely.** No respiratory protection required. (Air-purifying respirator with high-efficiency filters should be available if needed; half-face or full facepiece).

- **Routine maintenance where there is reasonable likelihood of ACM disturbance.** Air-purifying respirator with high-efficiency filters (half-face or full facepiece).

- **Maintenance or repair involving intentional small-scale disturbance of ACM.** Powered air-purifying respirator with high-efficiency filters, or air-purifying respirator with high-efficiency filters (half-face or full facepiece). If glove bags are used to contain the ACM during disturbance, either half-face or full facepiece air-purifying respirators with high-efficiency filters may be used.

- **Any O&M activity requiring sawing, cutting, drilling, abrading, grinding, or sanding ACM.** (NOTE: specially equipped tools with local exhaust ventilation should be used for these activities. See 29 CFR 1910.) Powered air-purifying respirator with high-efficiency filters, or full facepiece, air-purifying respirator equipped with high-efficiency filters should be used.

- **Cleanup after a minor asbestos fiber release.** Air-purifying respirator with high-efficiency filters (half-face or full facepiece).

- **Cleanup after a major asbestos fiber release.** Air-supplied respirators, either the "Type C" airline respirator equipped with a backup high-efficiency filter or SCBA (Self-Contained Breathing Apparatus).

The U.S. EPA, in collaboration with NIOSH, has issued a guidance document, "A Guide to Respiratory Protection for the Asbestos Abatement Industry," which recommends levels of respiratory protection *for those engaged* in large-scale asbestos abatement projects that are beyond routine O&M procedures. Air-supplied self-contained, and "type C" airline respirators are the focus of the EPA/NIOSH document. These respirators allow workers to breathe fresh air supplied through hoses and face masks, and are generally used only by asbestos abatement workers engaged in large-scale asbestos removal projects. They are usually not considered either practical or necessary for most custodial and maintenance jobs.

An industrial hygienist or environmental/occupational healt professional should assist workers with respirator selectio and fitting, and train them in respirator use. Fit-testing (whic means determining whether a particular brand and size c respirator properly fits an individual worker) is essential, sinc respirators which leak at the face seal provide significantly les protection. OSHA requires fit-testing initially and every si months for employees required to wear a negative pressur respirator for protection against asbestos, or for individual exposed at or above the OSHA-specified limits.

A respirator's effectiveness is also influenced by how it i handled, cleaned, and stored. Custodial and maintenance staf should clean their respirators after each use, and disinfect thei respirators at the end of a day's use. This improves comfort and also reduces the chances of skin irritation or infection After cleaning the respirator, custodial and maintenance staf should place the respirator (with the worker's name) in a clear and sanitary location and store the unit in a secure place fo future use. Respirators should be visually inspected by the use before and after each use, during cleaning and at least monthly when not in use. Inspection records should be maintainec accordingly. When the respirator's high-efficiency filters are discarded, they should be disposed of as asbestos waste.

APPENDIX F

Existing EPA Guidance for Each Step That a Building Owner May Take to Control ACM

Action	Existing EPA Guidance/Regulations*
Appoint Asbestos Program Manager and Develop an Organizational Policy.	"Guidance for Controlling Asbestos-Containing Materials in Buildings" ("Purple Book") EPA publication number: 560/5-85-024
Inspect the facility to determine if ACM is present. Take bulk samples of suspect ACM and assess the material's condition.	"Guidance for Controlling Asbestos-Containing Materials in Buildings" ("Purple Book", chapter 2) EPA publication number: 560/5-85-024
	"Simplified Sampling Scheme for Surfacing Materials" ("Pink Book") EPA publication number: 560/5-85-030a
	"Asbestos-Containing Materials in Schools; Final Rule and Notice" (Asbestos Hazard Emergency Response Act, or AHERA). *Federal Register*—October 30, 1987. (sections 763.85 to 763.88)
	Model training course materials for accrediting asbestos building inspectors in accordance with AHERA (inspection/assessment materials).
Establish an O&M program.	"Purple Book", Chapter 3
	AHERA regulations, sections 763.91 and 763.92
	EPA Guidance for Service and Maintenance Personnel. EPA publication number 560/5-85-018
Implement and Conscientiously Manage the O&M Program; Assess the Potential for Exposure to Asbestos and Select Response Actions.	"Purple Book", Chapter 4
	Model training course materials for accrediting asbestos management planners in accordance with AHERA (assessment materials).
	AHERA regulations, section 763.88 and 793.92
Select and Implement Abatement Actions Other Than O&M When Necessary.	"Purple Book", Chapter 6
	AHERA regulations, section 763.93 (including 763.85 through 763.92)
	AHERA regulation, appendix A; Determining Completion of Response Actions-Methods.
	"Abatement of Asbestos-Containing Pipe Insulation" U.S. EPA; Asbestos-in-Buildings Technical Bulletin 1986-2.
	U.S. EPA National Emission Standards for Hazardous Air Pollutants (NESHAP) Regulations (40 CFR 61)
	Model training course materials for accrediting asbestos management planners in accordance with AHERA (assessment materials).

*Most of these guidance materials are available through EPA's TSCA Assistance Hotline, at (202) 554-1404.

APPENDIX G:

Sample List of Suspect Asbestos-Containing Materials

- Cement Pipes
- Cement Wallboard
- Cement Siding
- Asphalt Floor Tile
- Vinyl Floor Tile
- Vinyl Sheet Flooring
- Flooring Backing
- Construction Mastics (floor tile, carpet, ceiling tile, etc.)
- Acoustical Plaster
- Decorative Plaster
- Textured Paints/Coatings
- Ceiling Tiles and Lay-in Panels
- Spray-Applied Insulation
- Blown-in Insulation
- Fireproofing Materials
- Taping Compounds (thermal)
- Packing Materials (for wall/floor penetrations)
- High Temperature Gaskets
- Laboratory Hoods/Table Tops
- Laboratory Gloves
- Fire Blankets
- Fire Curtains
- Elevator Equipment Panels
- Elevator Brake Shoes
- HVAC Duct Insulation
- Boiler Insulation
- Breeching Insulation
- Ductwork Flexible Fabric Connections
- Cooling Towers
- Pipe Insulation (corrugated air-cell, block, etc.)
- Heating and Electrical Ducts
- Electrical Panel Partitions
- Electrical Cloth
- Electric Wiring Insulation
- Chalkboards
- Roofing Shingles
- Roofing Felt
- Base Flashing
- Thermal Paper Products
- Fire Doors
- Caulking/Putties
- Adhesives
- Wallboard
- Joint Compounds
- Vinyl Wall Coverings
- Spackling Compounds

NOTE: This list does not include every product/material that may contain asbestos. It is intended as a general guide to show which types of materials may contain asbestos.

APPENDIX H:

References

USEPA. 1984. U.S. Environmental Protection Agency. *National Emission Standards for Hazardous Air Pollutants.* 40 CFR 61. April 5, 1984.

USEPA. 1985. U.S. Environmental Protection Agency. *Measuring airborne asbestos following an abatement action.* Washington DC: USEPA. EPA 600/4-85-049. ("Silver Book")

USEPA. 1985. U.S. Environmental Protection Agency. *Asbestos in buildings: Simplified sampling scheme for surfacing materials.* Washington DC: USEPA. EPA 560/5-85-030A. ("Pink Book")

USEPA. 1985. U.S. Environmental Protection Agency. *Guidance for controlling asbestos-containing materials in buildings.* Washington DC: EPA 560/5-85-024. ("Purple Book")

USEPA. 1985. U.S. Environmental Protection Agency. *Asbestos in buildings: Guidance for service and maintenance personnel.* Washington DC: EPA 560/5-85-018. ("Custodial Pamphlet")

USEPA. 1986. U.S. Environmental Protection Agency. *Abatement of asbestos-containing pipe insulation.* Washington DC: Technical Bulletin No. 1986-2.

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USEPA. 1987. *Asbestos Abatement Projects: Worker Protection, Final Rule.* 40 CFR 763. February 1987.

USEPA. 1987. U.S. Environmental Protection Agency. *Asbestos-Containing Materials in Schools: Final Rule and Notice.* 40 CFR 763. *Federal Register,* October 30, 1987.

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USEPA. 1989. *Asbestos Ban and Phaseout Rule.* 40 CFR 763.160 to 763.179. *Federal Register,* July 12, 1989.

USEPA. 1989. *Guidelines for Conducting the AHERA TEM Clearance Test to Determine Completion of an Asbestos Abatement Project.* Washington DC: EPA 560/5-89-001.

USEPA. 1989. *Transmission Electron Microscopy Asbestos Laboratories: Quality Assurance Guidelines.* Washington DC: EPA 560/5-90-002.

U.S. Department of Labor: OSHA Regulations. 29 CFR 1910.1001 — *General Industry Asbestos Standard* and 29 CFR 1926.58 — *Construction Industry Asbestos Standard.* June 1986; Amended, September, 1988.

U.S. Department of Labor: OSHA Regulations. 29 CFR 1910.134 — *Respiratory Protection Standard.* June, 1974.

Keyes, Dale L. and Chesson, Jean. 1989. *A Guide to Monitoring Airborne Asbestos in Buildings.* Environmental Sciences, Inc., 105 E. Speedway Blvd., Tucson, Arizona 85705.

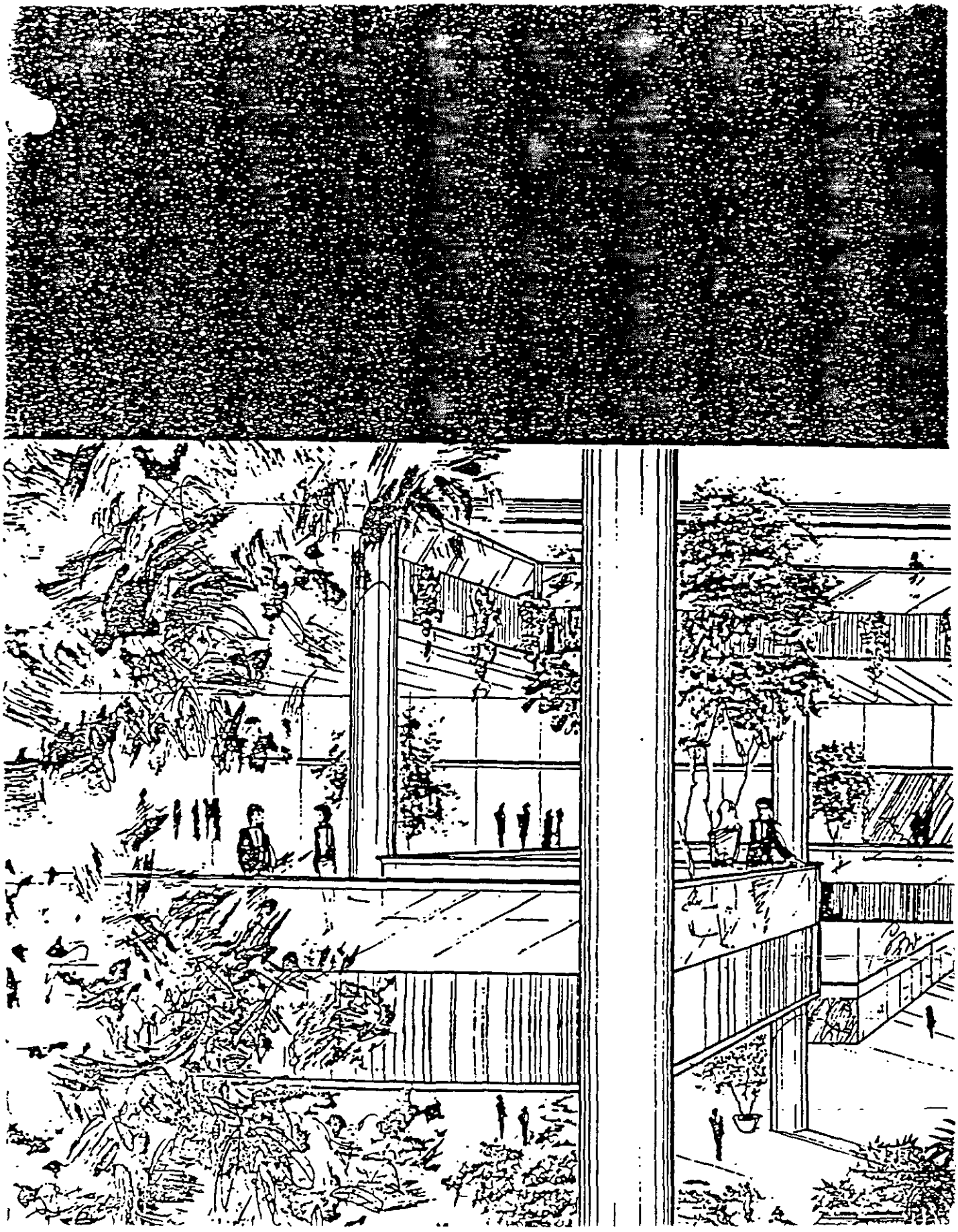

EXHIBIT 28

UNITED STATES DISTRICT COURT

DISTRICT OF MONTANA

MISSOULA DIVISION

PAUL PRICE, JOHN PREBIL and MARGERY PREBIL, on behalf of themselves and all others similarly situated, Plaintiffs, vs. W.R. GRACE & COMPANY (a Delaware corporation); W.R. GRACE & COMPANY-CONN (a Connecticut corporation); W.R. GRACE & CO., a/k/a GRACE, an association of business entities; SEALED AIR CORPORATION (a Delaware corporation), Defendants.	No. CV 00-71-M-DWM AFFIDAVIT OF DONALD J. HURST IN SUPPORT OF PLAINTIFFS' APPLICATION FOR PRELIMINARY INJUNCTION AND EMERGENCY NOTICE TO CLASS MEMBERS

PLAINTIFF'S EXHIBIT 28 MDL 1374

STATE OF WASHINGTON)
) ss.:
COUNTY OF SPOKANE)

DONALD J. HURST, being first duly sworn, deposes and states as follows:

1. I am president of Fulcrum Environmental Consulting, with offices in Spokane, Washington and Yakima, Washington.

2. My educational background includes a Bachelor of Science degree and a Masters Degree in geology from the University of Wyoming. Part of my training involved the geology of various minerals, including asbestos.

3. I have numerous certifications regarding the assessment, testing and abatement of asbestos. These asbestos certifications include AHERA Inspector/Management Planner and Project Designer, NIOSH Proficiency and Analytical Testing, EPA Bulk Analysis Quality Assurance Testing Program, OSHA 40 Hour Hazardous Materials and EPA Hazardous Materials Emergency Response Certification, OSHA 8 Hour Hazardous Materials and EPA Hazardous Materials Emergency Response refresher course. Additionally, I have been certified by the State of California as a registered environmental assessor.

4. I have been involved with a number of organizations that address asbestos, including the Environmental Information Association (former Member of Advisory Council), Spokane County Air Pollution Control Authority (current Member of Advisory Council), Montana State Asbestos Rules Advisory Committee (former Member).

5. I have conducted training sessions regarding asbestos assessment, testing and abatement, and I have authored articles regarding asbestos.

6. A substantial amount of work performed by Fulcrum Environmental Consulting, Inc. involves asbestos consulting. As president, I have been involved in all aspects of project performance, work plan and development, field investigation, analytical protocol, risk assessment and reporting regarding asbestos. I have been the project manager for numerous asbestos related projects, including projects involving the assessment and abatement of asbestos in all types of buildings in the Northwest. I am appending my curriculum vitae as Attachment A.

7. In April 2000, Fulcrum Environmental Consulting was hired by the Class Counsel in the case of Paul Price, et al. v. W.R. Grace Co., et al., No. 00-71-M-DWM. I was asked to conduct an exposure assessment for homes with W.R. Grace's vermiculite attic insulation. Specifically, I was asked to:

1) assess possible airborne fiber concentrations that result from specific activities that may take place in homes;

2) assess possible contamination of adjacent areas resulting from those activities;

3) identify reasonable safety precautions to be taken in order to prevent and minimize asbestos exposure; and

4) identify options for remedial action and estimate the cost of those options.

8. I was placed in contact with Randy Hatch who was in the middle of a renovation project at his home in Liberty Lake, just outside of Spokane, Washington. Mr. Hatch and his wife Susan were conducting remodeling work to their home in preparation for moving into the home. Upon learning about the potential problems relating to asbestos and vermiculite attic insulation, Mr. Hatch and his wife ceased work and agreed to allow their home to be tested in order to assess the problem.

9. I interviewed Mr. Hatch in detail and learned that the remodeling work conducted by him and his wife included removing and relocating interior walls, removing part of the ceiling, removal of loose insulation to enable renovation, work area housekeeping, and cutting various openings into the ceilings for plumbing, electrical wiring, and electrical fixtures.

10. On March 31, 2000, I collected bulk samples from Mr. Hatch's home and arranged to have it analyzed by Microlab Northwest. The results of the analysis indicated that the fine dust contained slightly less than 1% of asbestos on a count basis, and approximately 1/10 of 1% of asbestos by weight. The analysis report is appended as Attachment B.

11. On April 12, 2000, I conducted a simulation of the activities previously performed by Mr. Hatch and collected air samples in order to determine the exposure levels that occurred.

12. The activities conducted were intended to closely simulate the work performed by Mr. Hatch and included the demolition of walls, the drilling of holes into the ceiling, the shoveling

and vacuuming of the attic insulation, and sweeping/vacuuming of the dust and emptying of the vacuum into bags.

13. The simulation activities were videotaped and I prepared a narrative for that videotape. A true and accurate copy of the narrated videotape is appended as Attachment C.

14. The asbestos air concentrations that resulted from the simulation activities are appended as Attachment D. Notably, all personal samples documented fiber concentrations in excess of the .1 fibers/cc permissible exposure limit set by OSHA, and range from .31 to 5.6 fibers/cc.

15. The air samples were also analyzed by a transmission electron microscope, which has greater sensitivity and a substantially higher resolution that allows one to identify the types of fibers present in the air. The results of the analysis of personal samples by transmission electron microscope ranged from less than 0.18 to 6.4 s/cc (actinolite). (See Attachment D)

16. I have reviewed reports of simulated testing of Zonolite Attic Insulation conducted by Grace in the 1970s. In particular, I have reviewed Grace's testing dated March 11, 1976, July 11, 1976, April 27, 1979 and March 1980. Based on the Grace test results that I reviewed, the asbestos airborne concentrations during the testing that I performed simulating renovation activities appear to be consistent with the concentrations that Grace achieved during installation.

17. Additionally, surface dust samples were collected at Mr. Hatch's home. The results are appended as Attachment E, and document the presence of asbestos (actinolite-tremolite) fibers in surface dust obtained from 20 of 21 sample locations in the Hatch residence. In the one sample in which the presence of asbestos was not confirmed, actinolite-tremolite was indicated in the sample but not specifically identifiable due to other constituents obscuring optical information.

18. Based on my experience and testing, it is my opinion to a reasonable degree of scientific certainty that disturbance of Grace's vermiculite attic insulation during ordinary renovation activities results in airborne levels of asbestos substantially higher than allowed by regulation without training and respiratory protection.

19. Further, it is my opinion that Grace's vermiculite attic insulation is capable of

releasing asbestos fibers into the air and contaminating indoor air and resulting in accumulation of asbestos-containing dust on horizontal surfaces.

20. It is my opinion, based on my experience and testing of Mr. Hatch's house, that horizontal surfaces within the house are contaminated with asbestos from the vermiculite attic insulation.

21. It is my opinion that future activities in this home can resuspend this dust and result in exposure to airborne fibers. Accordingly, it is my recommendation that non-porous surfaces in the house be cleaned by wet-wiping and HEPA vacuuming, and that porous surfaces be removed and disposed of as asbestos-contaminated dust if cleaning is not effective.

22. Based on my experience and my testing, it is my opinion that all activities conducted in the vicinity of Grace's vermiculite attic insulation that can disturb the insulation itself or the surrounding dust could create an exposure hazard and should be conducted utilizing strict safety precautions to prevent exposure.

23. Based on my experience, the activities should be conducted by persons specially trained in asbestos work practices and should not be conducted by homeowners who are not specifically trained to use the necessary safety precautions when working around asbestos. The safety precautions necessary would include the use of respirators commensurate with the level of exposure indicated by testing, setting up of containment and negative air, wetting down of the material and surfaces in the vicinity of the material, use of HEPA vacuum cleaners, and decontamination of personnel and materials exposed during work activities.

24. Based on my experience and my testing, it is my opinion that homeowners need to be warned about: 1) the presence of asbestos in Zonolite Attic Insulation; 2) the potential hazards associated with disturbing Zonolite Attic Insulation and asbestos dust from the insulation; 3) the need for strict safety precautions when working around this material; and 4) that work involving disturbance of insulation and dust from the insulation should be conducted by persons specifically trained to work around asbestos.

DATED this 19th day of July, 2000.

DONALD J. HURST

SUBSCRIBED AND SWORN to before me this 19th day of July, 2000.

Notary Public in and for the State of Washington
Residing at Spokane WA
My commission expires: 9/20/00

A

Resume

DONALD J. HURST **FULCRUM ENVIRONMENTAL CONSULTING**

PRINCIPAL IN-CHARGE

EDUCATION: B.S., Geology, University of Wyoming, Laramie, WY, 1981.

M.S., (Sedimentary Tectonics) Geology, University of Wyoming, Laramie, WY, 1984.

Contract Management and Administration, Montana Department of State Lands, Missoula, MT, 1985.

Industrial Hygiene Techniques and Hands-on Laboratory for Measuring and Evaluating Environmental Pollutants, Northwest Center for Occupational Health and Safety, Seattle, WA, 1987.

Comprehensive Review of Industrial Hygiene Practices, Midwest Institute of Occupational Safety and Health, Minneapolis, MN 1988.

Principles of Hazardous Materials Chemistry, Hazardous Waste Conference, Seattle, WA 1989.

Essentials of Environmental Liability and Superfund Law, Montana Continuing Legal Education Association, Billings, MT 1990.

Comprehensive Introduction to Underground Storage Tanks Procedures and Practices, Colorado School of Mines, 1990.

REPRESENTATIVE EXPERIENCE:

1990 - Present Fulcrum Environmental Consulting, Inc. **Principal-in-Charge**

Mr. Hurst is President of Fulcrum Environmental Consulting. He has overall administrative responsibility for projects, including oversight of Fulcrum's subconsultants and subcontractors. As Principal-in-Charge, his administrative responsibilities include performance schedules, quality control, contract negotiations, and payment requests.

In addition, Don's technical involvement includes peer review of all aspects of project performance, work plan development, field investigation, analytical protocol, risk assessment, and reporting. He is directly involved with oversight of field investigations including hazardous materials investigations, subsurface sampling, and report generation. Representative experience includes:

EXHIBIT
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- Project manager for AHERA management plans and 3-year reinspection audit for nine school districts in eastern Washington which encompassed 368 buildings and 6,500,000 ft^2 of interior space.

- Project manager for design and management for Boundary County Community Hospital asbestos abatement project. Project spanned three years and two architectural firms. Major concerns critical to the project's success were minimizing total abatement costs while achieving renovation goals, ensuring effective coordination between contractors, and managing patient/staff safety concerns.

- Project manager to provide asbestos management services for the remodel of the Frederick and Nelson (F&N) building. Project design called for complete interior demolition of the building leaving only structural support intact. Coordination of asbestos removal with the demolition contractor was critical to prevent delays in project scheduling. The asbestos abatement was completed on time, within budget, and with no change orders.

- Project manager for pre-abatement scoping and asbestos survey for two buildings on the EWU campus scheduled for remodel and demolition. Earlier survey work documented ACMs that required removal prior to remodeling. Need for pre-remodel removal of other ACMs was less clear. As part of the survey, regulatory status and need for removal of questionable ACMs were determined. The results of the inspection were incorporated into the remodel/renovation conceptual design scope of work.

- Project manager for project design, work specifications, and on-site services in close cooperation with multiple West Valley School District architects and construction management teams associated with the District's on-going $20 million modernization. Asbestos has been removed from over 220,000 ft^2 of building space scheduled for demolition or remodel.

- Project manager for major renovation of two Grant County P.U.D. facilities. Each facility was composed of several separate buildings fused together with multiple renovations. Hazard quantification was further complicated by complex and rapidly evolving modernization plans. Primary concerns were to ensure that renovation schedule was not unexpectedly or unfavorably impacted by asbestos abatement and that occupants remaining in the facility were not affected by abatement.

- Project Manager to integrate asbestos abatement into the general demolition plan of an old junior high school. The school was built in 1924 and had over 81,000 ft^2 of space. Timing was critical to prevent delay of demolition to allow the construction of a new Albertson's outlet. The project objective was to incorporate pre-demolition removal of friable asbestos into the general demolition contractor's scope of work with minimum impact on demolition and construction schedule. ACMs were categorized as either requiring specialized removal or removal with demolition.

- Project manager for numerous projects in eastern Washington and northern Idaho for Washington Water Power Co. Projects included discovery, preliminary assessment and site inspection, remedial design, and remedial oversight of numerous contaminants including petroleum products, PCB, metals, and asbestos.

- Project manager for system-wide audit of hazardous waste streams generated by 14 natural gas pipeline compressor stations and maintenance bases in Idaho, Washington, and Oregon for Pacific Gas Transmission Co.

- Project manager for development of an Oil Spill Contingency Plan and Spill Prevention Countermeasure and Control Plan for a 5.5 million gallon oil products storage facility in Spokane, Washington, for a confidential client.

- Project manager for Phase I, II, III Environmental Site Assessment for site location planning in eastern Washington for Walgreens, Inc.

- Project manager for preliminary assessment of environmental degradation of developed property adjacent to historical landfill and clay mining and brick manufacturing facility in Sandpoint, Idaho, for First Bank of Idaho.

- Project manager for site discovery, emergency cleanup, Phase II site investigation, and remediation oversight associated with deposit of arsenic-based herbicide in historical landfill in Prichard, Idaho, for United States Forest Service.

- Project manager for discovery, preliminary assessment, site inspection, and remedial planning of petroleum and heavy metals contamination at railroad servicing and maintenance facilities in Spokane, Washington, for Metropolitan Mortgage and Securities, Inc.

- Project manager for preliminary assessment of undeveloped property adjacent to historical landfill location in Osborne, Idaho, for First Security Bank of Idaho.

- Project manager for preliminary assessment, site inspection, and remedial design at diamond drill bit manufacturing facility in Spokane, Washington, for Diamond Drill/Blue Bore, Inc.

- Project manager for discovery, preliminary assessment, and site inspection of abandoned railroad and heavy industry property in Spokane, Washington, for Northbank Properties.

- Project manager for engineering evaluation and cost analysis, remedial design, and development of plans and specifications for removal of heavy metals and organic pesticides at Wenatchee, Washington, for Northwest Architectural Co.

1984 - 1990 Bison Engineering, Inc., **Engineering Geologist**

- Project manager for AHERA inspection and management plans for 2,200,000 ft^2 of occupied building space for the Renton Public Schools. Unique aspects of the project included utilization of Bison's Computerized Asbestos Data Management System (CADMS) was integral to risk analyses and control program cost projections.

- Project manager for AHERA inspection/management plans and subsequent abatement project management for approximately 2,000,000 ft^2 of occupied building space in rural North Dakota.

- Project manager for project design, work specifications and project management services for asbestos & lead-based paint abatement for the Great Falls Housing Authority. Comprehensive renovation had been designed and bid when architect recognized that asbestos containing materials and lead-based paint would severely impact project viability.

- Project manager for project design, work specifications, and on-site monitoring and supervisory services for Montana State Mental Hospital, asbestos abatement project. Inmates at the hospital are considered high security, extremely mobile, and mischievous. With the exception of areas to be abated, the hospital facility needed to remain accessible and functioning throughout abatement activity. Special work boundary construction considerations were incorporated into project design to accommodate these diverse project needs.

- Quality assurance officer for hazardous wastes and air toxics study on abandoned mine tailings from the Wickes Smelter, Corbin-Wickes Mining District, Montana, for the Montana Department of State Lands.

- Geologist on environmental assessment of the precipitated calcium carbonate (PCC) process at the Tacoma Lime Plant for Continental Lime, Inc.

- Project manager for air quality and toxic metal analysis of abandoned mine tailings at Corbin Flats, Jefferson County, Montana, for the Montana Department of State Lands. Detailed review of historical mining and milling processes was completed during the study.

- Project manager for Phase II drilling associated with site investigation of leaking underground storage tank system located in West Yellowstone, Montana, for Loomis Enterprises, Inc.

- Project manager for exposure monitoring and risk assessment of lead exposures associated with babbitt manufacturing in Columbia Falls, Montana, for Stoltz Lumber.

- Project manager for Phase II investigation of subsurface conditions associated with suspected leaks from Underground Storage Tanks at the Lolo and Savenak Work Centers, Montana, for the United States Forest Service.

- Project manager for preliminary assessment and feasibility study of soil and groundwater contamination at airport facilities in Helena, Montana, for the Helena Regional Airport.

1984 NRS, Inc., **Engineering Geologist**

- Geologist in charge of determining the age, provenance, sedimentology, and distribution of gold-bearing deposit to aid mine planning. Utilization of drill hole data to analyze bedrock irregularities and hydrologic conditions for the Chinese Diggings Mine at Boulder, Montana.

- Geologist providing initial geologic interpretation and expertise in the mine plan development and permit preparation for a placer gold mine at Lincoln, Montana.

1983 University of Wyoming, **Research Associate**

- Research of chronology and structural development of Wind River Mountain fault system.

1981 - 1983 Empire Laboratories, **Field/Lab Technician**

- Numerous project studies into soil stability and materials integrity associated with foundations, roads, and pond embankments.

1979 - 1980 Cooper and Clark Engineers, **Field Technician**

- Project Field Manager for evaporation pond construction of in-site uranium mine.
- Project field manager of structural inspection of railroad overpass construction.

CERTIFICATIONS:

- Registered Geologist, States of Wyoming and Oregon
- Trainer for Asbestos Worker and Contractor/Supervisor
- AHERA Inspector/Management Planner
- AHERA Project Designer
- NIOSH Proficiency in Analytical Testing (PAT) No. 59601-002
- EPA Bulk Analyses Quality Assurance Testing Program No. 8204
- Registered Environmental Assessor, California
- OSHA 40-Hour Hazardous Materials and EPA Hazardous Materials Emergency Response
- OSHA 8-Hour Hazardous Materials and EPA Hazardous Materials Emergency Response Refresher Course
- IFCI Certified Washington State Underground Storage Tank Assessor

PROFESSIONAL AFFILIATIONS/ AWARDS:

Member, Environmental Assessment Association
Member, Montana Mining Association
Member, Montana Geological Society
Member, Wyoming Geological Society
Member, American Association of Petroleum Geologists
Member, Advisory Council, Environmental Assessment Association
Member, Spokane County Air Pollution Control Authority, Advisory Committee
Member, Montana State Asbestos Rules, Advisory Committee 1989
Member, National Asbestos Council, 1988
Recipient, Gulf Oil Company Scholarship, 1982
Recipient, S. H. Knight Fieldwork Scholarship, 1981

PUBLICATIONS:

"Legislation Revises Asbestos in School Requirements", Montana School Boards Association Bulletin, 1986.

"Stratigraphy and Tectonic Significance of the Tunp Conglomerate in the Fossil Basin, Southwestern Wyoming", Mountain Geologist, 1985.

"Early Eocene Tectonics and Sedimentation in Northern Fossil Basin, Wyoming Overthrust Belt", AAPG-SEPM Sectional Conference, Salt Lake City, 1984 (co-author).

"Impingement of Thrust Belt Development on Foreland Structures," AAPG Regional Conference, Reno, Nevada, 1984 (co-author).

B

MICROLAB NORTHWEST
7609 140TH PL. NE
REDMOND, WA 98052
PHONE: (425) 885-9419

LABORATORY REPORT

TO: Chad Trent
Fulcrum Environmental Consulting
107 South Cedar Street
Spokane, WA 99204
PHONE: (509) 459-9220 FAX: (509) 459-9219
SUBJECT: Identification of Asbestos
SPECIMEN: Three Zonolite Samples.
REFERENCE:

REPORT #: 851-00
DATE: April 10, 2000

INTRODUCTION

Three samples of "Zonolite" insulation were received in small ziplock bags for an evaluation of the asbestos minerals present. The samples were marked as "#070-01", "#070-02", and "#070-03". The samples were processed one at a time to prevent any cross contamination. Each sample was placed in a flat bottomed plastic container and gently shaken to allow the fines to settle to the bottom of the container. The larger particles of vermiculite were then poured back into the plastic bag and a tapelift of the fines was made for quantitative analysis and for general characterization of the minerals present. Four mounts were made of each sample for this analysis. Samples of the fines were also analyzed in individual refractive index standard liquids to characterize the fibrous minerals in more detail. The more detailed optical analysis was conducted using polarized light and phase contrast dispersion staining.

RESULTS

All of the samples contained significant amounts of fibrous minerals. The most common fibrous mineral was asbestiform tremolite-actinolite. This mineral is one of the controlled asbestos minerals. The optical properties ranged from the iron poor tremolites to the higher iron content actinolites. The refractive indices along the length ranged from 1.635 to 1.645, and normal to the length of 1.605 to 1.623. Extinctions varied from about 11 degrees oblique to about 18 degrees oblique. Some anthophyllite was also detected but at much lower levels. The anthophyllite was characterized as having parallel extinction, orthogonal cleavage, and refractive indices ranging through 1.620 to 1.640 normal to the fiber length and 1.640 to 1.665 parallel to the length. If the fiber was not large enough to exhibit orthogonal cleavage it was not considered as anthophyllite. This is also a controlled asbestos mineral. There were a variety of other fibrous minerals present, including fibrous talc, that are not specifically cited as a controlled asbestos mineral though the health effects may be similar.

The quantification was done by point counting though this method is not appropriate of this sample. The majority of fibers counted were very small, typically less than a three orders of magnitude less in volume than the other particles counted. In this case the point count over

EXHIBIT
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estimates the fiber content significantly due to the difference in shape and size of the non-fibrous minerals present. At least two hundred particles were counted on each of the four slides for each sample. The results are not representative of the entire sample but rather only the fines. All of the fibers counted were fibrous minerals though they may not all have been a controlled asbestos mineral. Only two the fibers counted represented large bundles of tremolite-actinolite asbestos. The remaining fiber counts were predominantly tremolite-actinolite fibers that had diameters of less than a micrometer.

SAMPLE	TOTAL COUNT	FIBER COUNT	% ASBESTOS COUNT*
070-01	842	8	0.95%
070-02	887	7	0.79%
070-03	812	8	0.98%

* Percent by weight is less than a tenth of this value

The exposure to the dust from handling these materials would be enriched in fibrous minerals, predominantly tremolite-actinolite asbestos.

CONCLUSION

The samples all contain tremolite-actinolite asbestos as the dominant fibrous mineral. The amount of asbestos present in the sample is well below one percent by weight. Exposure to the dust from protracted handling of this material would be expected to exceed OSHA exposure limits.

Thank you for this opportunity to be of service. If I can provide any further assistance please contact me.

Signed: _____

E. R. Crutcher, Consultant

C

INSERT VIDEO
"Fulcrum Work Practices"

D

Sample ID #	Sample Description		Volume (liters)	PCM Analytical Results	TEM Analytical Results
	Type	Description/Simulation			
0070-01	General Area Sample	Obtained while preparing containment	695.80	0.016 fibers/cc	None Detected (<0.0087 S/cc)
0070-02	Work Area	Wall Demolition	205.80	0.452 fibers/cc	None Detected (<0.1953 S/cc)
0070-03	Personal	Wall Demolition	41.60	1.096 fibers/cc	0.5830 S/cc Actinolite
0070-04	Work Area	Drilling (prior to penetrating to attic)	156.80	0.380 fibers/cc	None Detected (<0.0387 S/cc)
0070-05	Personal Sample	Drilling (prior to penetrating to attic)	33.28	0.310 fibers/cc	None Detected (<0.1822 S/cc)
0070-06	Work Area	Drilling (during penetration to attic) and routing wire in attic	78.40	1.302 fibers/cc	0.3867 S/cc Actinolite
0070-07	Personal	Drilling (during penetration to attic) and routing wire in attic	12.48	Overloaded	6.4410 S/cc Actinolite
0070-08	Work Area (in attic)	Shoveling insulation in attic	421.40	0.826 fibers/cc	1.4307 Actinolite
0070-09	Personal	Shoveling insulation in attic	145.60	2.644 fibers/cc	0.1692 S/cc Actinolite
0070-10	Work Area (in first floor containment)	Shoveling and vacuuming insulation in attic	87.36	2.612 fibers/cc	None Detected (<0.4601 S/cc)
0070-11	Personal	Vacuuming in attic	31.20	5.614 fibers/cc	0.9872 S/cc Actinolite
0070-12	Work Area	Emptying shop-vac, sweeping and vacuuming debris in containment	55.62	4.064 fibers/cc	2.8905 S/cc Actinolite
0070-13	Personal	Emptying shop-vac, sweeping and vacuuming debris in containment	37.44	Overloaded	3.2729 S/cc Actinolite
0070-21	General Area Sample	Obtained after removal of containment	1225.00	0.004 fibers/cc	None Detected (<0.0025 S/cc)
0070-22	General Area Sample	Obtained after removal of containment	1225.00	0.004 fibers/cc	None Detected (<0.0049 S/cc)

EXHIBIT

EMSL Analytical, Inc.

382 South Abbott Avenue
Milpitas, CA 95035
Phone: (408) 934-7010 Fax: (408) 934-7015

Attn.: Chad Trent
Fulcrum Environmental Consulting, Inc.
South 107 Cedar
Spokane, WA 99201

Monday, April 17, 2000

Ref Number: CA002469
Analysis Date: 4/17/2000

PHASE CONTRAST MICROSCOPY (PCM) FIBER COUNT BY NIOSH METHOD 7400, ISSUE 2, 4TH EDITION, 8/15/94

Project: Asbestos Investigation

Sample	Location	Sample Date	Volume (liters)	Fibers	Fields	fibers/ mm²	LOD fib/cc	fibers/cc
0070-01			695.80	22 0	100	28 03	0.004	0.016
0070-02			205.80	110 0	58	241.6	0.013	0.452
0070-03			41.60	93.0	100	118.47	0.065	1.096
0070-04			156.80	102 0	84	154.69	0.017	0.380
0070-05			33 28	21.0	100	26.75	0.081	0.310
0070-06			78.40	102.0	49	265.18	0.034	1.302

Nonette Patron
Analyst

Approved Signatory

Disclaimers: LOD = Limit of Detection. This method assumes the limit of detection is 7 fibers/mm². The laboratory is not responsible for data reported in fibers/cc, which is dependent on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL.

Analysis performed by EMSL Milpitas (ELAP #1620)

EMSL Analytical, Inc.

382 South Abbott Avenue
Milpitas, CA 95035
Phone: (408) 934-7010 Fax: (408) 934-7015

Attn.: Chad Trent
Fulcrum Environmental Consulting, Inc.
South 107 Cedar
Spokane, WA 99201

Monday, April 17, 2000

Ref Number: CA002469
Analysis Date: 4/17/2000

PHASE CONTRAST MICROSCOPY (PCM) FIBER COUNT BY NIOSH METHOD 7400, ISSUE 2, 4TH EDITION, 8/15/94

Project: Asbestos Investigation

Sample	Location	Sample Date	Volume (liters)	Fibers	Fields	fibers/ mm²	LOD f/b/cc	fibers/cc
0070-07			12.48	Sample Was Overloaded				
0070-08			421.40	142.0	20	904.46	0.006	0.826
0070-09			145.60	157.0	20	1000	0.019	2.644
0070-10			87.36	107.0	23	592.63	0.031	2.612
0070-11			31.20	100.0	28	454.96	0.086	5.614
0070-12			55.82	106.0	23	587.09	0.048	4.064

Nonette Patron
Analyst

Approved Signatory

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PHASE CONTRAST MICROSCOPY (PCM) FIBER COUNT BY NIOSH METHOD 7400, ISSUE 2, 4TH EDITION, 8/15/94

Project: Asbestos Investigation

Sample	Location	Sample Date	Volume (liters)	Fibers	Fields	fibers/ mm²	LOD f/b/cc	fibers/cc
0070-13			37 44	Sample Was Overloaded				
0070 21			1225.00	10.0	100	12.74	0.002	0.004
0070-22			1225.00	10.5	100	13 38	0.002	0.004

Nonette Patron
Analyst

Approved Signatory

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Attn.: Chad Trent
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South 107 Cedar
Spokane, WA 99201

Tuesday, April 18, 2000

Ref Number. CA002497

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selected Area Electron Diffraction (SAED), and Energy Dispersive X-Ray Microanalysis (EDX) - Performed by EPA Level II Method

Basic TEM Summary Report

Project: Asbestos Investigation

Sample	Volume (liters)	Asbestos Type(s)	# STRUCTURES Asbestos	# STRUCTURES Non-Asb.	Analytical Sensitivity (S/cc)	Asbestos Concentration (S/mm²)	Asbestos Concentration (S/cc)
0070-01	695.80	None Detected	0	8	0.0087	<15.75	<0.0087
0070-02	205.80	Overloaded		0			
0070-03	41.60	Actinolite	4	6	0.1457	62.99	0.5830
0070-04	156.80	None Detected	0	4	0.0387	<15.75	<0.0387
0070-05	33.28	None Detected	0	4	0.1822	<15.75	<0.1822

Ronald K. Mahoney
Analyst

Approved Signatory

EMSL Analytical, Inc.

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Milpitas, CA 95035
Phone: (408) 934-7010 Fax: (408) 934-7015

Attn.: Chad Trent
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Sou h 107 Cedar
S, kane, WA 99201

Tuesday, April 18, 2000

Ref Number: CA002497

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selected Area Electron Diffraction (SAED), and Energy Dispersive X-Ray Microanalysis (EDX) - Performed by EPA Level II Method

Basic TEM Summary Report

Project: Asbestos Investigation

Sample	Volume (liters)	Asbestos Type(s)	# STRUCTURES Asbestos	# STRUCTURES Non-Asb.	Analytical Sensitivity (S/cc)	Asbestos Concentration (S/mm²)	Asbestos Concentration (S/cc)
0070-06	78.40	Actinolite	5	186	0.0773	78.74	0.3867
0070-07	12.48	Overloaded		0			
0070-08	421.40	Overloaded		0			
0070-09	145.60	Actinolite	8	48	0.0212	84.00	0.1692
0070-10	87.36	Overloaded		0			

Ronald K. Mahoney
Analyst

Approved Signatory

EMSL Analytical, Inc.

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Milpitas, CA 95035
Phone: (408) 934-7010 Fax: (408) 934-7015

Attn.: Chad Trent
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South 107 Cedar
Spokane, WA 99201

Tuesday, April 18, 2000

Ref Number: CA002497

Asbestos Fiber Analysis by Transmission Electron Microscopy (TEM), Selected Area Electron Diffraction (SAED), and Energy Dispersive X-Ray Microanalysis (EDX) - Performed by EPA Level II Method

Basic TEM Summary Report

Project: Asbestos Investigation

Sample	Volume (liters)	Asbestos Type(s)	# STRUCTURES Asbestos	# STRUCTURES Non-Asb.	Analytical Sensitivity (S/cc)	Asbestos Concentration (S/mm²)	Asbestos Concentration (S/cc)
0070-11	31.20	Actinolite	10	117	0.0987	80.00	0.9872
0070-12	55.62	Overloaded		0			
0070-13	37.44	Overloaded		0			
0070-21	1225.00	None Detected	0	0	0.0025	<8.00	<0.0025
0070-22	1225.00	None Detected	0	7	0.0049	<15.75	<0.0049

Ronald K. Mahoney
Analyst

Approved Signatory

EMSL Analytical, Inc.

Address 382 South Abbott Ave.
Address Milpitas, CA 95035
Phone: 408/934-7010 Fax: 408/934=7015

Wednesday, April 19, 2000

Client Name: Fulcrum Environmental Consulting, Inc.
Address : South 107 Cedar
Address Spokane, WA
Phone: 509/459-9220
Fax: 509/459-9219

Project: Asbestos Investigation / 0700
Attention: Chad Trent
Ref Number: CA002540
Page: 1 of 1

TEM Level II Analysis, Indirect Preparation

SAMPLE ID		ASBESTOS DETECTED STRUCTURES < 5	ASBESTOS DETECTED STRUCTURES ≥ 5	ASBESTOS DETECTED TYPE(S)	ANALYTICAL SENSITIVITY (s/cc)	ASBESTOS CONCENTRATION (s/cc)
0070-02		0	0	ND	0.1953	< 0.1953
0070-07		0	2	Actinolite	3.2205	6.4410
0070-08		1	14	Actinolite	0.0954	1.4307
0070-10		0	0	ND	0.4601	< 0.4601
0070-12		0	4	Actinolite	0.7227	2.8905
0070-13		0	3	Actinolite	1.0910	3.2729

Analyst

Comments Preliminary Report

Laboratory Manager

04/19/2000 15:59 408-934-7015 EMSL MILPITAS PAGE 02/02

CA0024497 - Lead #

EMSL Analytical, Inc.

CHAIN OF CUSTODY

Asbestos

CA0025450 - Resuspended Samples

EMSL Representative:	Will Gray		
Your Company Name:	Fulcrum Environmental	EMSL-Bill to:	Fulcrum Environmental
Street:	107 South Cedar	Street:	107 South Cedar Street
City/State:	Spokane, WA Zip: 99204-0625	City/State:	Spokane, WA Zip: 99204-0625
Phone Results to:	Fulcrum Environmental	Fax Results to:	Fulcrum Environmental
Name:	Chad Trent	Name:	Chad Trent
Telephone #:	(509) 459-9220	Fax #:	(509) 459-9219
Project Name/Number:	Asbestos Investigation/00070	Purchase Order #:	00070

MATRIX

X Air ☐ Floor Tile ☐ Soil
☐ Bulk ☐ Drinking Water ☐ Dust
☐ Wipe ☐ Wastewater

TURNAROUND

☐ 6-10 Days ☐ 72 Hours X 24 Hours ☐ Same Day*
☐ 5 Days ☐ 48 Hours ☐ 12 Hours ☐ 6 Hours
*S.D. - A.M. Delivery by Fed. Ex.-Results by Mid-Night or Earlier.

SAMPLE NUMBER	TOTAL TIME (minutes)	FLOW RATE (liters/min)	TOTAL LITERS	ANALYSIS: NIOSH 7400 (PCM)	ANALYSIS: AHERA Level 2 (TEM)	COMMENTS
0070-01	71	9.80	695.8	X	X	Analyze all samples PCM with method NIOSH 7400 and TEM with method AHERA Level . Any samples which cannot be analyzed by NIOSH 7402 will need to be analyzed using the indirect method.
0070-02	21	9.80	205.8	X	X	
0070-03	20	2.08	41.6	X	X	
0070-04	16	9.80	156.8	X	X	
0070-05	16	2.08	33.28	X	X	
0070-06	8	9.80	78.4	X	X	
0070-07	6	2.08	12.48	X	X	
0070-08	43	9.80	421.4	X	X	
0070-09	70	2.08	145.6	X	X	
0070-10	42	2.08	87.36	X	X	
0070-11	15	2.08	31 2	X	X	Please contact Chad Trent prior to conducting analysis using the indirect method.
0070-12	18	3.09	55.62	X	X	
0070-13	18	2.08	37.44	X	X	
0070-21	125	9.80	1225	X	X	
0070-22	125	9.80	1225	X	X	

Client Sample # (s) 0070-01 to 0070-22 Total Samples: 15

Relinquished: Chad Trent Date: 4-17-00 Time: 11:45

Received: [signature] Date: 4-14-00 Time: 9:15 a.m

Received: _____ Date: _____ Time: _____

E

MICROLAB NORTHWEST
7609 140TH PL. NE
REDMOND, WA 98052
PHONE: (425) 885-9419

LABORATORY REPORT

TO: Chad Trent
Fulcrum Environmental Consulting
107 South Cedar Street
Spokane, WA 99204
PHONE: (509) 459-9220 FAX: (509) 459-9219
SUBJECT: Particle Identification
SPECIMEN: Seven Sets of Tapelift Samples
REFERENCE:

REPORT #: 860a-00
DATE: April 26, 2000

INTRODUCTION

Seven sets of three each tapelift samples were received for an identification of asbestos if present. The tapelifts were marked as "070-TP01" through "070-TP21". The tapelifts were placed on clean microscope slides and immersed in acetone for about two hours and then removed. The slides with the tapelifts were rinsed with clean acetone as they were removed from the immersion tank. The tapelifts were allowed to dry for ten minutes and then mounted using a synthetic resin (Eukitt). The completed mounts were analyzed using analytical light microscopy.

RESULTS

Tremolite-actinolite asbestos was identified in every sample with the single exception of sample #7. In sample #7 a number of fibrous minerals were present and some of those were probably asbestos, but that could not be confirmed because of the limitation of the optics imposed by the adhesive in the mount. Every fiber identified as asbestos in these samples had refractive indices much higher than the adhesive/resin, had oblique extinction between 11 and 18 degrees, exhibited fibril structure, had a birefringence of about 0.02, showed a positive sign of elongation, and exhibited molecular asymmetry (darker in the NW and SE quadrant). This combination is unique for the tremolite-actinolite series.

CONCLUSION

Tapelift samples #1 through #6 and #8 through #21 contained tremolite-actinolite asbestos. Sample #7 probably contained asbestos but a fiber in the proper orientation to confirm asbestos was not seen among the numerous fibrous minerals present.

Thank you for this opportunity to be of service. If I can provide any further assistance please contact me.

Signed: _____
E. R. Crutcher, Consultant

EXHIBIT
E